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As a result of the development of new mathematics curriculums on all levels, the need for inservice education of teachers is critical. This conference met in order to study existing programs and to report promising practices, to explore ways of financial support, and to develop plans for pilot programs in states where assistance is needed.

In spite of much progress, many mathematics teachers have not been reached by inservice education, especially in elementary schools. Most personnel teaching inservice programs have been from universities and state departments of education, but other sources should be tapped to provide the number of instructors needed. Funds from local districts, business and industry should supplement what is now available from state and national sources. Programs should be increased. Courses could be made more widely available by the use of media such as television, films and teaching machines.

This bulletin includes reports on in-service education programs from selected states, panel reports on the role of professional organizations and government agencies in planning and supporting in-service programs, and the deliberations of the conference seminars. Check lists give advice on starting or expanding a program, in financing it and evaluation.

The appendix includes a bibliography.

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INSERVICE MATHEMATICS EDUCATION

Promising Practices for Elementary and Secondary School Teachers

INSERVICE MATHEMATICS EDUCATION: Promising Practices for Elementar

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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Office of Education

HIGHLIGHTS OF THE CONFERENCE

- Much has been done in the field of inservice education by the National Science Foundation and by State and local school systems,

  BUT

  there remains a tremendously large number of mathematics teachers yet to be reached, especially in elementary schools.

- Mathematics personnel from colleges and universities and consultants from State Departments of Education have taught most of the inservice classes,

  BUT

  other sources must be tapped to provide the large number of additional instructors needed.

- National Defense Education Act funds and regular and special appropriations of State funds have provided leadership to initiate and develop inservice programs,

  BUT

  local school districts, business and industry, and other sources will need to be encouraged to carry out the responsibility for inservice education.

- Many recent graduates are equipped to teach the updated curriculums in mathematics,

  BUT

  there are still many recent graduates whose traditional courses have not acquainted them with the new mathematics.

- There are many strong inservice programs operating at both State and local levels,

  BUT

  increased demands for upgrading are necessitating extensive enlargement of such programs.

- A variety of teaching techniques has been used,

  BUT

  inservice courses can be made more widely available and more effective by the use of such media as television, kinescopes, films, filmstrips with and without sound recordings, transparencies for use with overhead projectors, teaching machines, programed materials.

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Bulletin 1964, No. 36

INSERVICE MATHEMATICS EDUCATION

Promising Practices for Elementary and Secondary School Teachers

Report of a conference held under the joint auspices of the U.S. Office of Education and the National Council of Teachers of Mathematics, Washington, D.C., March 7–8, 1963.

Prepared by
VERYL SCHULT, *Specialist in Mathematics*
and
THEODORE L. ABELL, *Research Assistant, Mathematics*

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
ANTHONY J. CELEBREZZE, *Secretary*

Office of Education
FRANCIS KEPPEL, *Commissioner*

Educational Materials Laboratory
Office of Education
OCT 1964
DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

"The uppermost concern of State Supervisors (of mathematics) is, no doubt, the total inservice mathematics program for both elementary school teachers and secondary school teachers."

Newsletter of
Association of State Supervisors
of Mathematics,
April 1963.

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Foreword

The explosive growth in technology which has changed our way of life and extended our horizons to outer space has resulted to a great extent from recent developments in mathematics. These developments have led to a thorough reexamination of what is being taught in mathematics. In the last decade, much experimentation has gone on and new curriculums have been introduced, from kindergarten to college. Because many teachers are now being asked to teach aspects of mathematics that are unfamiliar to them, the need for inservice education is critical.

In response to requests for help in planning inservice programs in mathematics for teachers in both the elementary and secondary schools, the U.S. Office of Education sponsored a national conference in Washington, D.C., on March 7–8, 1963, to study the problem. The National Council of Teachers of Mathematics cooperated by bringing its Committee on Inservice Education to meet with the selected State supervisors of mathematics who were invited by the Office of Education. After the Conference, this committee met to consider ways of implementing ideas and plans developed at the Conference.

The Conference had three main objectives:

1. To study and discuss existing programs for mathematics teachers in selected States and to report promising practices.
2. To explore ways and means of financial support for local and State inservice programs.
3. To develop plans for implementing pilot inservice programs in States where assistance is needed.

This publication contains the reports delivered by the State supervisors who attended the Conference, the panel reports delivered by representatives from professional organizations and government agencies, the deliberations of the seminars, and selected checklists. (A summary of the written reports from

State supervisors who did not attend the Conference was furnished to all conferees and the information from these was incorporated into the seminar reports.)

Gratitude is expressed to all who contributed to the success of the Conference. A list of participants can be found in the Appendix.

Eric R. Baber
Assistant Commissioner
Division of Elementary and Secondary Education

J. Dan Hull
Director
Instructional Programs Branch

Contents

Page

FOREWORD ... III

INTRODUCTION ... 1

CONFERENCE PROGRAM ... 8

REPORTS ON INSERVICE PROGRAMS IN SELECTED STATES

California, George L. Roehr ... 7
District of Columbia, Jane M. Hill ... 13
Georgia, Gladys M. Thomason ... 19
Idaho, G. Richard Kay ... 26
Illinois, Gussie Phillips ... 30
Maryland, Lewin A. Wheat ... 38
New York, Frank S. Hawthorne ... 45
Pennsylvania, Carl E. Heilman ... 48
Rhode Island, Arthur J. McMahon ... 58
Texas, Irene St. Clair ... 63
Virginia, Isabelle P. Rucker ... 67
Washington, Robert R. Willson ... 71

PANEL REPORTS ON THE ROLE OF PROFESSIONAL ORGANIZATIONS AND GOVERNMENT AGENCIES IN PLANNING AND SUPPORTING INSERVICE PROGRAMS

American Association for the Advancement of Science, John R. Mayor ... 77
Conference Board of the Mathematical Sciences, Leon W. Cohen ... 78
Mathematical Association of America, Bruce E. Meserve ... 80
National Aeronautics and Space Administration, James V. Bernardo ... 81
National Council of Teachers of Mathematics, Frank B. Allen ... 84
National Science Foundation, C. Russell Phelps ... 85
U.S. Office of Education:
  Instructional Resources Branch, Harry L. Phillips ... 88
  Educational Media Branch, Thomas D. Clemens ... 90

Page

DELIBERATIONS OF THE CONFERENCE SEMINARS

1. Who Starts Inservice Programs? 93
2. How Can Qualified Instructors Be Provided in Quantity? 96
3. What Uses of Newer Media Are Being Made in Inservice Education? 98
4. How Can Mathematics Inservice Programs Be Financed? 100
5. What Is the Role of Professional Organizations and Federal Agencies in Inservice Education? 102
6. How Should Parents Be Informed of the Changing Mathematics Curriculum? 105
7. What Are Some Special Features of Present Inservice Programs? 107
8. How Can Pilot Projects Be Started? 112
9. Some Unanswered Questions and Problems 113

CHECKLISTS

1. Getting an Inservice Program Started 115
2. Expanding Inservice Programs 116
3. Financing Inservice Programs 118
4. Evaluating Inservice Programs 118

APPENDIX

Participants in the Conference 121
Bibliography 125

Introduction

"What's wrong with the old mathematics?"
"Aren't 2 and 2 still 4?"
"Why is there a 'revolution' going on in mathematics?"
"If we sit tight do you think the excitement about mathematics will blow over?"
"Why was I not taught this exciting kind of mathematics which my pupils now have the fun of studying?"

Questions like these are being asked by teachers, school administrators, and parents. Such questioning is part of an active upsurge of interest in the new mathematics which has led to the largest "back to school" movement in mathematics ever witnessed in this country.

Following are some evidences of this interest in continuing education in mathematics:

- The National Science Foundation has spent about $90,000,000 of tax money on mathematics institutes for secondary school teachers. In 1963–65, $34,000,000 will be spent on secondary school mathematics teachers.
- By the end of June 1963, more than 8,000 elementary school teachers in Illinois were enrolled in State-sponsored workshops in elementary mathematics.
- Eighty-seven percent of the junior and senior high school mathematics teachers of Rhode Island were involved in in-service courses in mathematics during the school year 1961–62.
- The State of Georgia paid approximately $375,000 as grants-in-aid to teachers of the State (many in mathematics) for summer study in colleges and universities during the summer of 1962.
- A class in the "new" mathematics for parents was set up in Arlington, Va., at which about 40 parents were expected. Over 100 appeared!

- In 1960 there were only two experimental mathematics programs in the public schools of one State. In 1963 only two school systems in that State were not using some experimental programs. Every new program requires some inservice reeducation of the teachers.

Such facts are counterbalanced by other figures such as these:

- Of the 100,000 secondary school teachers of mathematics in the United States, only about 30,000 have attended one or more National Science Foundation institutes.
- Of approximately 1,000,000 elementary school teachers in grades K–6, less than 0.1 percent have had an opportunity to participate in National Science Foundation institutes in mathematics.
- Twenty-nine States require no undergraduate courses in mathematics for certification of elementary school teachers. In fact, elementary school teachers spend from 10 to 20 percent of their day teaching mathematics, and yet for many of them undergraduate mathematics courses made up less than 2 percent of their undergraduate program.

The participants in the Conference, who had a wealth of knowledge and experience in inservice education, set about to find solutions to the problems caused by situations like these. The Conference was an illustration of the proverb: "It is always interesting when shopkeepers talk shop; it only gets boring when bootmakers try to talk about chiffon." Through prepared reports, panel discussions, and seminar sessions, the participant "shopkeepers" hammered out some very satisfactory solutions to the problems of inservice education which we hope the reader will find helpful.

Conference Program

THEME: Promising Practices in Inservice Education for Mathematics Teachers

PURPOSES:

1. To study and discuss existing inservice programs for mathematics teachers in selected States and to report promising practices.
2. To explore ways and means of financial support for local and State inservice programs.
3. To develop plans for implementing pilot inservice programs in States where assistance is needed.

LENGTH OF CONFERENCE: Two days, exclusive of travel time.

LOCATION: U.S. Office of Education, Room 12003

DATE: March 7–8, 1963

Program

March 7, 1963

9:00 a.m. Opening Session Chairman: Dr. J. Dan Hull
Greetings—Dr. Eric R. Baber
Dr. Ralph J. Becker

9:15 a.m. Reports on inservice programs in selected States:

Virginia	(Mrs. Rucker)
Texas	(Mrs. St. Clair)
Rhode Island	(Mr. McMahon)
Maryland	(Mr. Wheat)
California	(Mr. Roehr)
Washington	(Mr. Willson)

10:30 a.m. Coffee break

11:00 a.m. Discussion Session I
Leader: Dr. Edwina Deans
Recorder: Mrs. Gussie Phillips
Topic: What are the strengths, weaknesses, and needs?

12:00 Noon Lunch

1:30 p.m. Second Session Chairman: Mr. Harry L. Phillips
Reports on inservice programs (continued):

Idaho	(Mr. Kay)
District of Columbia	(Miss Hill)
Georgia	(Mrs. Thomason)
Illinois	(Mrs. Phillips)
Pennsylvania	(Mr. Heilman)
New York	(Mr. Hawthorne)
Other unique programs	(Dr. Deans)

3:00 p.m. Coffee break

3:30 p.m. Discussion Session II
Leader: Dr. Clarence B. Lindquist
Recorder: Mr. Frank Hawthorne
Topic: What are the best ways that have been used to finance inservice programs?

5:00 p.m. Recorders and leaders meet

March 8, 1963

9:00 a.m. Third Session Chairman: Miss Veryl Schult
Summary of discussion sessions I and II:
Mr. Frank Hawthorne
Mrs. Gussie Phillips

9:30 a.m. Panel discussion
Topic: What is the role of professional organizations and government agencies in planning and supporting inservice programs?
Chairman: Dr. John R. Mayor, American Association for the Advancement of Science
Participants:
Dr. Leon W. Cohen, Conference Board of Mathematical Sciences
Mr. Frank B. Allen, National Council of Teachers of Mathematics
Dr. Bruce E. Meserve, Mathematical Association of America
Dr. C. Russell Phelps, National Science Foundation
Mr. James V. Bernardo, National Aeronautics and Space Administration

Mr. Harry L. Phillips, U.S. Office of Education
Mr. Thomas D. Clemens, U.S. Office of Education
Recorders: Dr. James Zant
Miss Anna Marie Evans

10:45 a.m. Coffee break

11:45 a.m. Discussion: Planning and supporting inservice programs
Discussion leader: Dr. Kenneth E. Brown
Recorder: Dr. Bruce Vogeli

12:30 p.m. Lunch

1:30 p.m. Final Work Session Chairman: Dr. Lauren G. Woodby
(All participants meet in Room 12003 for briefing)

1:40 p.m. Seminar A (Meets in Room 12003)
Leader: Dr. E. Glenadine Gibb
Recorder: Miss Jane M. Hill
Participants:
Dr. Patricia Spross
Dr. Lauren G. Woodby
Mr. Carl E. Heilman
Mr. Frank S. Hawthorne
Mr. G. Richard Kay
Mrs. Irene St. Clair
Dr. Edward H. Whitmore
Dr. James Zant
Dr. Bruce E. Meserve

Seminar B (Meets in Room 20012)
Leader: Mr. Frank B. Allen
Recorder: Mrs. Agnes Y. Rickey
Participants:
Dr. Edwina Deans
Mr. Harry L. Phillips
Mr. Arthur J. McMahon
Mrs. Gussie Phillips
Mr. George L. Roehr
Mr. Myrl H. Ahrendt
Dr. Clarence B. Lindquist
Mr. James V. Bernardo
Dr. John R. Mayor
Dr. William Guy

1:40 p.m. Seminar C (Meets in Room 40017)
Leader: Dr. J. Fred Weaver
Recorder: Mrs. Isabelle P. Rucker
Participants:
Miss Veryl Schult
Dr. Kenneth E. Brown
Mrs. Gladys M. Thomason
Mr. Lewin A. Wheat
Mr. Robert R. Willson
Dr. C. Russell Phelps
Dr. Bruce Vogeli
Miss Anna Marie Evans
Dr. Leon W. Cohen

4:45 p.m. All participants meet in Room 12003

5:00 p.m. Conference adjourns

Reports on Inservice Programs in Selected States

The papers of the State mathematics consultants were presented on the first day of the Conference and in the sequence listed in the Conference Program. For ease of reader reference, they are presented here in alphabetical order, by State.

Although the U.S. Office of Education is responsible for editing the papers, the conclusions and interpretations are those of the authors, and do not necessarily represent the views of the Office.

California

GEORGE L. ROEHR
Consultant, Bureau of Secondary Education
State Department of Education
Sacramento, Calif.

From Oregon to Mexico, California stretches about 1,000 miles. The State has about 3,800,000 elementary and high school pupils, whose education is conducted by about 1,600 school districts; 346 of these districts operate high schools. In general, California schools are large, both the urban and suburban-rural schools.

The established and traditional training for teachers at the high school level is a 5-year program, and at the elementary level, a 4-year-plus program. In the districts operating all grades from kindergarten through grade 12, a single salary-schedule based upon training and experience is common. Many of our teachers are not "homegrown;" we import about half of our annual need, a practice that may change in the next 15 years. Population growth is a major problem; Los Angeles, for example, must increase its teaching staff by 1,000 teachers for the coming year and Los Angeles does not even have the highest growth rate.

Among the active professional organizations in California whose work closely affects teachers and administrators is the California Mathematics Council, which, through its *Bulletin*, provided general circulation for a statement, "Strands of Mathematical Concepts," before it was published by the State. This statement was drawn up by the State Advisory Committee on Mathematics.

There are factors in California that have a negative effect upon the instructional program in mathematics: Credential requirements for elementary teachers have not included content courses at the college level. Only recently have mathematics departments concerned themselves with mathematics courses appropriate for elementary teacher training. The supply of secondary teachers with majors in mathematics has been insufficient. The financial structure of California has met tremendous demands in terms of building and equipping schools. While this was purely a local responsibility in the past, the situation has so changed that, since 1947, the State has spent more than $1.2 billion on building and equipping schools. School administrators have been preoccupied with housing, equipping, and financing schools, along with staffing them.

Inservice education in California is characterized by local initiative, involvement of different kinds of institutions, and cooperation among independent agencies. Naturally this leads to a variety of patterns of inservice education. The unique function of the State department of education is to provide guidance for curricular content, to stimulate curriculum activity, and to aid cooperative endeavors for inservice education.

What is the format of inservice education in this complex? While certain authority for approval resides with the State educational agency, responsibility for curriculum development lies with the local operational unit, the school district. It follows that there are no State syllabi or courses of study, although there are State textbooks for the first eight grades. The role of the State department of education is essentially one of information and persuasion. Those responsible for these activities are not willing to act solely on the basis of their own training, experience, and wisdom, but seek in addition the most competent guidance available. This policy has been operative in the social sciences as well as in mathematics, science, and foreign languages. Evidence of this policy is found in the "Report of the Committee on High School Mathematics Courses" that appeared in the September 1960 issue of *California Schools*. Three thousand reprints of this report were distributed at the 1961 annual meeting of the National Council of Teachers of Mathematics. This policy was still pursued in the establishment of the Advisory Committee on Mathematics for the California Curriculum Commission, the body responsible for recommendations on textbook selection for the elementary schools.

In contrast to procedures found elsewhere, personnel from the California State department of education have not undertaken direct teacher-education activities. We have initiated and participated in conferences of 1 or 2 days in length to survey desirable curricular changes in mathematics and to stimulate school systems and teacher-training institutions to undertake inservice education activities of suitable duration. We have also organized and directed 2- and 3-week seminars or workshops devoted to examination of curriculum proposals as supported by instructional materials that held promise for effecting improvement in mathematics education. Each of these conferences or workshops involved groups of people or institutions that were already organized to undertake inservice education programs. Representative of such programs are the Extension Services of the University of California and of the several California State colleges.

Under Title III of the National Defense Education Act, there have been numerous inservice education programs for which consultant-instructors were provided. These teachers of teachers came from college faculties and from district staffs having specialists in mathematics.

One of the most important inservice education agencies is the individual municipal school system. Again, our particular service to these systems has been to provide expert advice on the curriculum and information on current thinking relevant to their operational decisions, for example, information on a recent consensus that teaching mathematics from a structural point of view shows promise of having greater educational value for the general student than does teaching it by organizing the content around areas of application.

We are only now beginning to explore a desirable curricular relationship between mathematics and vocational and technical training. We must identify experts competent to provide guidance for this aspect of mathematics instruction.

I will now give a rather detailed view of the workings of a current project which is an integral portion of State planning for inservice education at the junior high school level.

California High School Mathematics Curriculum Project, Grades 7–9

The State Curriculum Commission has recently urged the adoption of new textbooks for grades K–8. It has recommended that the books be selected by January 1964 and be placed in use in September 1965. But the Advisory Committee on Mathematics also anticipated that the new textbooks would be sufficiently different so that inservice education for teachers using them would be essential. Specific recommendations were made concerning inservice education. The project described below seeks to realize some of these recommendations.

Organization of the project

A Coordinating Panel of 10 members, 5 mathematicians and 5 public school people with the consulting guidance of Professor E. G. Begle of Stanford University, and six Regional Panels, are preparing materials for teachers in the junior high school grades. Regional Panels range in size from 9 to 14 members; each Panel has a consulting mathematician. The project involves 12 mathematicians from two campuses of the University of California, three independent colleges, and seven State colleges.

The State department of education appointed the chairman and vice chairman of each Regional Panel and selected the teachers composing the balance of the Panel from nominations made by school districts throughout the State. All of the largest districts are involved. Three county school offices are represented on panels.

Inservice education: The big goal

The task of each Regional Panel is to produce a handbook to aid teachers in the instruction of a selected unit conforming to the curriculum recommendations of the Advisory Committee on Mathematics. Approximately 4 weeks was the specified length for each unit; variation in the unit topic was anticipated.

The Coordinating Panel prepared preliminary outlines. The content of six topics, as indicated by summary phrases and sentences, follows:

I. Whole Numbers—to be presented with an historical approach on numeration as a refresher; stemming from work with finite sets, concept of number is developed as a property of sets. Treatment of problems of numeration, place value, and base; operations emerge from set relations using the associative, commutative, distributive properties; special properties of zero and one presented; addition-subtraction and multiplication-division relationships developed; algorithms emerge out of comprehensions of numbers, numeration, and principles of operation; work includes ideas of primes, factors, and exponents.

II. Geometry—an intuitive development of geometric elements, shapes, and forms as these are viewed in mathematics; the universal view of sets of points initiated; concrete figures and constructions employed to facilitate intuitive abstraction; accuracy and consistency observed in language used.

III. Measurement—evolving a unit of measure and its general nature; arbitrary and standard units of measure; counting and measuring, the number of measures; the approximate nature of measurement; measuring lines, areas, volumes, and angles; indirect measurement; the metric system.

IV. Rational Numbers—rational numbers as ordered pairs of integers, division by zero excluded; geometric interpretation of fractions by decomposition of rectangles into congruent pieces; different fractional names for numbers, different fractional names for one; evolve algorithm for addition using commutative and associative properties, with subtraction as the inverse of addition; evolve algorithm for multiplication of fractions using commutative, associative, and distributive properties, with division as the inverse of multiplication.

V. Decimals, Ratio, and Percentage—ratio as an ordered number pair *sans* division by zero, hence related to fractions; decimal numbers and percentages as numeration forms; types of repeating decimals; computational algorithms founded on knowledge of equivalent notation using the different terms; geometric and other proportions as interpretations of ratio; scientific notation from decimal numbers.

VI. Inequalities, Absolute Value, and Graphing—the ordering of numbers on a number line; symbols of inequality; geometric interpretation, both linear and plane, of inequalities; the language and operations of sets applicable to simple inequalities. Absolute value, defining the term; vector interpretations; consistency in the extraction of roots. Correspondence between points of a plane and ordered pairs of real numbers; statements that describe sets of ordered pairs of real numbers.

These six topics can only suggest some of the content area to be included in each unit of instruction written for students and accompanied by a handbook that provides the teacher with the background necessary to teach such a unit.

The Department plans to make the handbooks available to all junior high school teachers as individual documents and to make the related student material available to districts in manuscript form, should the districts care to supply it in quantity to their classes.

This project is supported in part by NDEA funds; this partial support is essential.

The project's place in inservice education

1. It provides an answer to the questions, "What topics are most important?" and "What aspects of these topics are most worthy of study?"
2. The answers that it provides have been made by experts who are most likely to be known to the people who make decisions about the instructional programs; for many of these it will be a matter of accepting the judgment of qualified authorities; for others, a matter of augmenting and confirming judgments already made.
3. With a confirmed course of action indicated, leadership in a school system can focus upon such personnel aspects as which teachers are likely to benefit through inservice education and who would be the most effective instructor for them.
4. The program is flexible; it can supplement existing instruction to the extent found to be feasible for each situation.
5. It is transitional. The State department of education will supply the teacher's handbook for as many teachers as desired upon request from each district.
6. It has a major goal: new textbooks to be in use by September 1965 that will contain material that relates well with the topics and treatment of them that are now being prepared.

District of Columbia

JANE M. HILL
Assistant Director, Department of Mathematics
District of Columbia Public Schools
Washington, D.C.

Inservice programs in the public schools of the District of Columbia can be considered in three broad categories:

a) courses taught at the District of Columbia Teachers College
b) courses or institutes sponsored in the local area by the National Science Foundation, and
c) activities sponsored by the Mathematics Department.

The District of Columbia Teachers College works closely with the public schools. Courses are planned on occasion to meet the specific needs of the schools. These are offered in the late afternoons, evenings, and Saturdays at a nominal cost to District of Columbia residents and teachers. Examples of such specially scheduled courses include a course on new ideas in geometry for secondary schools, one on new ideas in elementary algebra, and one on arithmetic for Basic classes. These courses are directly related to recent developments in the mathematics curriculum of the District of Columbia schools.

Many District of Columbia teachers have participated in one or more National Science Foundation Summer Institutes and Academic Year Institutes. The National Science Foundation has also sponsored institutes in the local area, in which District of Columbia teachers have participated. The summer institutes at the University of Maryland in 1958 and 1959 were of particular interest because the University of Maryland Mathematics Projects texts are used by District of Columbia Schools for seventh- and eighth-grade Honors classes.

The mathematics curriculum in the District of Columbia Schools is currently under revision. The revision is being done by committees of teachers working with supervisors. The work of the curriculum committees, one for junior high and one for senior high, has both stimulated inservice programs and provided inservice experience for the committee members. When the revised seventh-grade course of study was completed, members of the curriculum committee conducted afternoon workshops on each unit. The same thing was done for the eighth-grade course of study.

The high school curriculum committee has been concerned with the future course in geometry. Dr. Eugene Ferguson served as a consultant for the committee in March 1962. The committee has set up an experimental course in integrated plane and solid geometry for the year 1962–63. In conjunction with this course, at least two meetings of inservice education value have taken place. One was a departmental meeting to which principals and counselors were invited. At this time a panel of teachers discussed the problems involved. The other meeting was a small group discussion, an exchange of experiences among those in the experimental course. The small group discussions of common problems or interests have proved both popular and beneficial, and have been used on several occasions.

National Defense Education Act funds have been used to provide consultants, Miss Alice Hach and Dr. Eugene Ferguson, and to finance two courses for intensive study of the University of Maryland Mathematics Project textbooks during the year 1959–60.

Selected District of Columbia schools participated in a School Mathematics Study Group (SMSG) evaluation project in which a consultant was provided by SMSG. During the year 1960–61, a professor of mathematics from the University of Maryland met regularly with teachers using SMSG books. Content of SMSG courses was discussed and questions were answered.

For the last 5 years two outstanding junior high school teachers of mathematics have been released from classes to work with other teachers in their regular classes. This has proved a valuable inservice program. These two coordinators have taught demonstration classes, demonstrated teaching materials, and conducted discussion meetings on teaching techniques. This project is known as the Mathematics Improvement Program for Junior High Schools.

All activities thus far mentioned have been on the secondary level. The elementary schools are under a separate program of supervision. The District of Columbia Teachers College has also provided a series of courses for elementary school teachers. These are closely related to the elementary school course of study, which was revised in 1960. One of the courses, a seminar for teachers of Honors classes, prepared two supplementary units for use in Honors classes in the elementary schools. The units were not written for a specific grade. They were planned with above-average students in mind. Another course, Modern Arithmetic Teaching, is offered in at least four centers each semester because of the large number of teachers interested in it.

The talents of an unusually capable elementary school teacher are being used in a very profitable way. During 1961–62 this teacher taught a series of demonstration lessons. The lessons were taught at all grade levels and to classes of different ability levels. Each day's session consisted of the demonstration (approximately an hour) and then a discussion with the teachers who had observed the demonstration. Attendance at these demonstrations was voluntary. During the year this special teacher taught 57 demonstration lessons, and about 1,200 elementary school teachers attended the demonstrations and discussions. She worked in two demonstration schools, the first half of the year in one and the second in the other.

In 1962–63 this same teacher has again been released from a regular classroom assignment. This year's program began with a series of four 2-hour conferences with principals. The conferences were directed toward improved supervision. A series of questions was discussed in detail; for example, are recurring and varied contacts with fundamentals being provided? is there emphasis upon thinking? is there a continuum of mathematical ideas? is there provision for practice, drill, and mastery? After such questions had been discussed, the principals observed a demonstration class taught by an average teacher. Then, as a group, the principals evaluated the observed lesson in terms of the questions previously discussed. The principals have requested another series of meetings. This will be directed toward a study of the elementary school course of study.

This year the special teacher has also conducted a series of demonstrations for groups of teachers. There was one series for teachers of Basic classes (classes for pupils retarded in fundamental skills in reading and arithmetic) and one for teachers of Honors classes.

There is another series underway for selected school resource representatives, one each for primary and intermediate grades. This series will include a morning demonstration and conference and six afternoon conferences. It is hoped that in the future each school may be able to plan its own inservice program after the principal and at least two teachers have had some directed experiences in the teaching of arithmetic.

For the remainder of the school year another talented teacher will also be working in the program described above. This second teacher has also done some demonstration work with teachers. She participated in the American Association for the Advancement of Science program on the evaluation of special teachers for arithmetic and science and also in the experimental teaching of School Mathematics Study Group materials. For 2 years she taught demonstration lessons for teachers in one section of the city. With the two teachers working together, the inservice program in the elementary schools may be expanded for the future.

Neither programed learning material nor television has been used to date in any organized way for inservice work. Individual teachers have followed the nationally televised mathematics courses. Several have considered programed courses for review. These have been purely individual efforts. As recently as December 1962, a committee was appointed to explore the possibilities of a television course for elementary school teachers on the teaching of arithmetic. There are some promising prospects.

As already indicated, National Defense Education Act funds have provided for some inservice programs. District of Columbia Teachers College has some financial allotment for inservice courses and this has been used for mathematics on several occasions.

To help evaluate the inservice programs offered in the District of Columbia schools, individuals who have participated in the various activities have been asked for reactions and criticisms. These have been carefully considered in planning subsequent programs.

Summary of mathematics inservice offerings in D.C., 1957–63

I. Courses offered by District of Columbia Teachers College

  A. June 1958.
  Two weeks—Professionalized Arithmetic. A workshop in the structure of arithmetic taught by visiting instructor, Miss Allene Archer. 78 participants.

  B. Academic year 1958–59.
  One semester—Modern Mathematics for Junior High School Teachers. A course stressing the logical structure of algebra, background mathematics for junior high school teachers.

  C. Academic year 1960–61.
  One semester—Intensive study of School Mathematics Study Group geometry text. The course had a dual purpose: (a) to introduce a "modern" geometry course, and (b) to prepare junior high school teachers for the teaching of geometry in ninth-grade Honors classes.

  D. Academic year 1961–62.
  One semester—Modern Mathematics for Junior High School Teachers. The text used was the seventh-grade School Mathematics Study Group text. (Also offered in summer 1962.)
  One semester—Geometry in the Secondary School.
  One semester—Teaching Arithmetic to Basic Classes. A course planned for teachers of pupils who are retarded in fundamental skills and understandings.

E. Academic year 1962–63.

One semester—Modern Mathematics for Junior High School Teachers. (See above)

One semester—Teaching Arithmetic to Basic Classes. (See above)

One semester—Elementary Algebra.

To provide background for "modern" topics in elementary algebra. Text used: School Mathematics Study Group First Course in Algebra.

F. Courses offered for elementary school teachers, 1960–63.

One semester—Structure of Arithmetic.

One semester—Mathematics for Elementary School Teachers.

One semester—Modern Arithmetic Teaching.

One semester—Seminar for Teachers of Honors Classes.

In this course two units were prepared for use as supplementary material for Honor classes: Sets, Numbers, and Numeration; Geometry and Measurement.

II. Courses and Institutes in the D.C. area sponsored by the National Science Foundation.

Summers, 1958 and 1959—University of Maryland.

Institute stressing University of Maryland Mathematics Project content.

Fall 1958—American University.

One semester—Foundations of Mathematics. This course has been offered in subsequent years also.

Academic year 1960–62—District of Columbia Teachers College. Program of inservice education.

III. Activities sponsored by the Mathematics Department.

A. Academic year 1959–60.

One semester—Mrs. Helen Garstens, Associate Director of the University of Maryland Mathematics Project.

Mrs. Garstens directed an intensive study of the University of Maryland Mathematics Project seventh-grade text.

One semester—Dr. Mervin L. Keedy, Associate Director of the University of Maryland Mathematics Project.

Dr. Keedy directed an intensive study of the University of Maryland Mathematics Project eighth-grade text.

All expenses for these two series were paid from National Defense Education Act funds.

B. January 1959.

Dr. Sheldon Myers, Educational Testing Service.

Dr. Myers spoke on ways in which the new emphases in mathematics curricula are affecting standardized testing. This was a departmental meeting for the teachers of mathematics.

C. Academic year 1960–61.

Dr. James A. Hummel, Professor of Mathematics, University of Maryland.

Selected classes participated in a School Mathematics Study Group evaluation program conducted by the Educational Testing Service.

In conjunction with this, consultant services were provided.

A series of meetings was scheduled, during which Dr. Hummel discussed the questions on mathematical content raised by the participating teachers.

D. February 1962.

Miss Alice Hach, Supervisor of Mathematics, Ann Arbor, Mich.

Miss Hach met with two different groups: elementary supervisors and principals, and secondary school teachers of mathematics. In both instances there was a lecture-demonstration of teaching aids purchased by National Defense Education Act funds. The purpose of the meeting was to encourage schools to make more effective use of materials purchased by National Defense Education Act funds.

E. March 1962.

Dr. Eugene Ferguson, Chairman of the Mathematics Department, Newton High School, Newton, Mass.

Dr. Ferguson served as a consultant for the senior high school curriculum committee, and also was the speaker at a meeting for the junior and senior high school teachers. The topic of specific concern was the future course in geometry.

F. April 1962.

Superintendents' meeting.

At this time the Mathematics Department presented for for *all* school officers—supervisors in all departments and principals from all grade levels—and for the teachers of mathematics a program entitled "A Revolution in Mathematics."

G. 1960–62.

Curriculum Workshops.

Small groups of teachers involved in or interested in teaching specific courses met together. These included:

1. A meeting on the use of Vance's *Unified Algebra and Trigonometry* as a text.
2. A meeting on the use of an experimental course integrating plane and sold geometry.
3. A series of meetings on the units in the revised course of study for grades seven and eight.
   1960–61: Units in the seventh-grade course.
   1961–62: Units in the eighth-grade course.

H. 1962–63.

Meetings for Teachers New to the Department.

1. A 2-day preschool workshop.
2. Afternoon demonstrations of selected units from the mathematics course of study. Experienced classroom teachers conducted the demonstrations.

I. 1957 to present.

Mathematics Improvement Program for Junior High Schools.

Two outstanding junior high school teachers of mathematics are released from classes to work with other teachers in the 23 junior high schools. Through this program specific help is given to new teachers and to those teaching out of their field.

Georgia

Gladys M. Thomason
Coordinator, Mathematics Education
State Department of Education
Atlanta, Ga.

Georgia has 159 counties and a school district in each one. In addition, there are 38 independent districts in cities and towns within some of the counties. In the State's 197 school systems there were, in 1962, 1,930 schools—1,412 elementary schools and 518 high schools.

Each school system is headed by a superintendent, who is either elected by the people or appointed by the local school board. School systems range in size from those having fewer than 25 teachers to those having several thousand. If a school system has as many as 50 teachers, it may hire a curriculum director, who is paid from State-allotted funds. The curriculum director is in charge of the instructional program in the system. Of Georgia's school systems, 117 have curriculum directors.

An awareness of need by the State department of education and a recommendation of the Georgia Mathematics Council, an affiliate of the Georgia Education Association and the National Council of Teachers of Mathematics, led to the hiring of a State mathematics consultant in the fall of 1959. The consultant, through her teaching experience in many parts of the State, her service on State educational committees, and her role of leadership in the Georgia Mathematics Council, was already widely known by teachers and school administrators throughout the State. One of her first activities after joining the staff of the State department of education was to attend regional conferences of school principals to inform them of the service she could give to their mathematics teachers. Almost immediately, she had more requests than she could fulfill.

Although there was evidence of improvement in the systems that the consultant reached, the status of mathematics teaching in the State still was not good. With almost 2,000 schools in an area of more than 60,000 square miles, one person working with individual schools or school systems could not possibly accomplish what needed to be done. Some overall State guidance or acceptable plan for reaching more of the systems was necessary.

In 1960, a State Mathematics Advisory Committee was appointed by the Director of the Curriculum Unit of the State department of education. This committee, composed of representatives chosen from the State's superintendents, high school principals, elementary principals, curriculum directors, elementary teachers, and high school mathematics teachers, met with the State mathematics consultant. From these meetings came the suggestion that a State mathematics guide be written and distributed to teachers to assist them in planning the mathematics curriculum for their students and to offer suggestions for carrying out their plans.

A chairman for the writing group was elected by the Advisory Committee, and he and the consultant, working together, selected a writing committee. The committee was very carefully chosen to represent all areas of the State and to include classroom teachers and administrators. The writing committee began work in late summer of 1960.

They met for a week, and arranged to have speakers of national reputation address them and outline trends and changes in the mathematics curriculum. The committee members had an opportunity to examine experimental materials and reference books. They decided upon a philosophy and began work on an outline. Work was continued during the school year. Materials were examined and studied, and the committee was called together on three weekends during the year to continue work on outlines and plans.

The committee lost and gained some members during the year. There were 19 members who met with 4 members of the State department of education staff to do the actual writing of the guides. For 5 weeks in the summer of 1961 the committee worked—discussing, writing, checking on sequence of materials, agreeing on concepts and how they were to be presented. The members were paid a salary for the summer's work and travel expenses. A smaller committee worked for an additional week, editing the material and getting it ready for the printer.

The guide was published in a limited edition and issued to 27 systems to be used in pilot schools during the school year 1961–62. In order to provide leadership for the pilot schools, 16 curriculum directors, with a special grant from the State department of education, attended a summer workshop in mathematics at the University of Georgia. The workshop was conducted by two staff members, one from the Department of Mathematics, the other from the School of Education. These curriculum directors served as coordinators for the pilot projects in their school systems. Other pilot projects were headed by members of the guide-writing committee. These persons directed inservice programs for their pilot teachers, secured from the teachers written evaluations of material in the guide, and sent these to a revision committee. The curriculum directors and the writing committee have been leaders in acquainting the public with changes in mathematics—speaking at meetings of civic organizations, teaching P.T.A. study groups, and in one instance, arranging for a series of tapes to be made by teachers and shown over an educational television channel.

The Mathematics Education Coordinator, together with the two mathematics consultants who were added to the staff in the fall of 1960, worked very closely with the pilot schools during the year 1961–62. They held a series of inservice meetings in those schools to work on new content in mathematics. Specialists from the U.S. Office of Education also worked with those teachers. The program of the Fall Conference of the Georgia Mathematics Council at Rock Eagle was concerned with content and purpose of the guide.

The revision committee for the guide, composed of some of the members of the original writing committee, met for three weekends during the school year and for 2 weeks in the summer of 1962. Material was revised in accordance with recommendations from the pilot schools.

The guide was printed in three volumes in sufficient quantity that each teacher of mathematics in grades K–12 could have a copy. Copies were sent to the school systems upon request from the system superintendent. Copies of the guide were also given to colleges to use in teacher-training classes.

Publishing the tentative guide in a limited edition for pilot schools had a good psychological effect on other mathematics teachers. They heard about the guide at meetings they attended and from pilot teachers for almost a year before it was available to them. When copies were given to them in the fall of 1962, they were eager to have them, and acceptance has been rather good. The teachers' lack of information about topics in the guide has led to widespread inservice work in mathematics.

Many of the activities of the consultants, while not directly concerned with inservice work, do have an effect on it. The consultants compile lists of books and materials, which are distributed to teachers; serve on committees for school evaluations; work with the architect and building committee when new rooms for mathematics classes are being built; preview and evaluate mathematics films before they are purchased for State film libraries; speak on programs for curriculum directors, principals, and superintendents; meet with mathematics teachers of individual schools to help evaluate and to make suggestions for improving their mathematics offerings and to help organize local inservice programs; serve as judges of mathematics projects and papers at science fairs; work with the State mathematics television teacher in planning her programs; attend regional meetings for the purpose of evaluating the television lessons; and serve as adviser to the Georgia Mathematics Council.

The officers of the Georgia Mathematics Council and the State mathematics consultants have worked cooperatively to improve mathematics education in the State. The Council has grown in membership, having now about 500 members, many of whom are elementary school teachers. Each year, the Council has a meeting in each Congressional district, a 2-day statewide conference in the fall, and an affiliate meeting in the spring during the annual Georgia Education Association meeting. Programs this year have been on implementation of the guide. Capable elementary and secondary school teachers, staff members of the State department of education, and specialists from the U.S. Office of Education have appeared on programs. Attendance at these meetings has shown tremendous increase. In the 6 years that the statewide conference has been held, attendance has grown from 120 to about 500, and attendance of elementary school teachers has increased from 5 to about 250. Through the efforts of the Mathematics Coordinator and the Council, *The Arithmetic Teacher* and *The Mathematics Teacher* have been added to the State Library List, and may now be purchased for school libraries from State-allotted funds. Individual membership in the National Council of Teachers of Mathematics has also grown. The Georgia Council and the mathematics consultants are working now on plans for increasing membership, improving the Council newsletter, and improving the Fall Conference, and on a request for a cosponsored meeting of the National Council.

The Mathematics Coordinator is compiling a manpower list of Georgia teachers similar to the one done by the National Council of Teachers of Mathematics. This list includes persons who have attended National Science Foundation (NSF) Summer or Academic Year Institutes, persons who have had Grants-in-Aid from the State department of education, teachers who have shown through their work with the Georgia Council or in their classrooms that they have leadership ability. These persons are recommended to serve on committees, to appear on programs, to write articles for the newsletter, and to direct inservice activities.

After distribution of the guide, "Mathematics for Georgia Schools," in the fall of 1962, the number of requests for the services of the mathematics consultants was greatly increased. In order to reach more school systems the consultants have held a series of regional inservice meetings this year. Each of the 15 regions was visited 3 times. Meetings were held after school and were from 2 to 4 hours in length. Teachers from grades 1–12, curriculum directors, principals, and superintendents have attended these meetings. Big topics of general interest to all mathematics teachers were presented by the consultants—the Language of Sets, Numeration with Ten and Other Bases, Number Systems and their Properties, Problem Solving, Relations and Functions, Geometry in Elementary and Junior High School, etc. The main purpose of these meetings was to create interest among teachers and to give them confidence so that they would form inservice groups within their school system or enroll in a mathematics class in summer school. About 3,500 teachers from more than 100 school systems have attended these meetings. The consultants also conduct summer workshops of 1 or 2 weeks' duration in individual school systems. It is the intention of the State department that activities begun in the summer workshop be continued through the year in the belief that they will result in improved instruction in the classroom.

On a questionnaire sent recently to all of Georgia's 197 school systems, 72 percent of those reporting indicated that they were participating in, or had plans for beginning, some form of mathematics inservice education. Programs range from those in which there are occasional meetings under the direction of a local teacher to those having carefully planned meetings with an outside consultant hired by the local school system to give regular instruction in mathematics.

The following information was secured from the questionnaire:

Number of systems reporting		157
Number having inservice programs		89
For elementary school teachers only	29	
For secondary school teachers only	2	
For both	58	
Number planning inservice programs		16
Number not engaged in inservice work and not planning to, but who have sent representatives to regional meetings sponsored by State department of education		18
Number who had opportunity to attend regional meetings, but did not		7
Number not engaging in inservice work and not being reached by State department consultants		26

Of the 40 systems which did not report, a number are known to have inservice programs and others are known to be sending representatives to regional meetings conducted by State mathematics consultants.

Until this year, a reasonable amount of money has been available to the State mathematics supervisor for payment to consultants for services at local workshops of 1 day's or 1 week's duration and for appearing on programs of statewide conferences. This year, most of these programs have been financed by the local schools in various ways:

1. Some systems have paid for teachers of mathematics to go to a university for a summer and then, during the school year, these teachers have worked with the elementary school teachers in their system.
2. Some schools are paying several of their teachers who have studied mathematics recently to serve as instructors for inservice classes.
3. Other schools are giving certain teachers 1 or 2 free periods each day to compensate for their services as instructors.
4. A few systems are paying a teacher from another system to come one evening each week to work with their teachers.

5. At least two systems have arranged to have instructors work with their teachers for a period of 2 weeks during the summer.
6. Twenty-seven systems paid the expenses for some of their teachers to attend the 2-day State conference.
7. One system, in cooperation with the University television staff, presented a lesson each Monday evening for 10 weeks, using teachers at different levels. These telecasts were in viewing area of 33 systems.

The State department of education Grant-in-Aid Program for summer work gives many teachers an opportunity to go back to school in the summer. Any Georgia teacher who has a bachelor's degree and achieves a certain score on the National Teachers Examination may apply. Since 92 percent of Georgia's teachers now have bachelor's degrees, most of them are eligible for a grant. This grant gives $300 for 6 weeks of summer work and $450 for 9 weeks of work. The teacher must promise to teach in Georgia for 1 year after receiving a grant. Attendance is not restricted to Georgia colleges and universities. A person may attend school in any State as long as he is studying in an approved graduate program which leads to a Georgia 5th- or 6th-year teaching certificate. In 1960, 29 of the 538 grants were for secondary school teachers who were doing graduate work in mathematics. Forty of the 935 grants in 1961 and 40 of the 992 grants in 1962 were for secondary school mathematics teachers. Although no definite information is available about the number of elementary teachers who have studied mathematics on the Grant-in-Aid Program, it is known that many of them are studying mathematics.

The Mathematics Coordinator and consultants are now planning their activities for the school year 1963–64. During that year, they hope to reach some of the systems where no interest in improving mathematics has been shown. They plan to work more closely with experimental programs now going on in the area of the academically talented and in programed learning. They plan to concentrate most of their inservice activities on the junior high school level. Some systems are on the 1–7 and 8–12 plan; some on a 1–6, 7–9, 10–12 plan; and others on a 1–8, 9–12 plan.

The University of Georgia and the State department of education are working on a cooperative plan to train teachers to direct inservice activities. About 36 well-qualified mathematics teachers will attend a 6-week workshop at the University of Georgia this summer to learn how to teach inservice classes—they will be studying materials, methods, concepts, etc. During the year, at various centers across the State, they will teach mathematics courses for teachers for which graduate credit will be given. The teachers will work under the direction of a staff member of the University Mathematics Department. This will afford an opportunity for teachers who cannot attend summer school to receive quality instruction in mathematics.

The State department of education and the University of Georgia also cosponsor consultative services of University staff members for science and mathematics departments of secondary schools, very similar to the services offered by the Mathematical Association of America.

The State department of education has two teachers for television classes in mathematics—one teacher for middle grades and the other for upper elementary. Each teacher presents 66 lessons of 30 minutes in length; 6 of these lessons are inservice lessons for teachers. Next year, 30 lessons will be presented at 3:30 in the afternoon for teachers. It is expected that State-operated television programs will be in reach of 80 percent of the schools next year. The State supervisor is working with the University toward securing a National Science Foundation grant for television inservice education for teachers of mathematics.

There is still much that needs to be done for mathematics education in Georgia, but the consultants feel that progress has been made. Enthusiasm and interest are high. On the recent questionnaire sent to school systems, the systems indicated that the activities which had had most influence in getting local inservice work started were publication of the State department guide, inservice meetings held by the State consultants, and the State Conference sponsored by the State department of education and the Georgia Mathematics Council.

Idaho

G. Richard Kay
Supervisor, Science and Mathematics
State Department of Education
Boise, Idaho

Project Idaho is designed to upgrade and update mathematics instruction in the State of Idaho. The thesis of this project is that it is possible to use some of our highly-trained mathematics teachers, who have had recent study in their field, to conduct inservice courses for other teachers in the local districts. The project is directed by the State supervisor of science and mathematics. The colleges and universities in the State are supplying members of their staff to act as consultants and instructors. The National Council of Teachers of Mathematics has looked favorably on the proposal, and will support the effort with a financial grant and consultant services. The U.S. Office of Education is interested in this pilot project, and has contributed by giving Idaho the services of its mathematics specialists. This cooperative inservice project is intended to fill the need of making modern mathematics instruction available to a large number of our teachers.

The reasons for conducting this project may be summarized by stating a series of assumptions that apply to the status of mathematics instruction and to mathematics teachers in Idaho and perhaps in other States as well.

1. The opportunity to improve subject matter competence should be available to all teachers. This opportunity is not available to the majority of Idaho teachers.
2. All teachers of mathematics should have the opportunity to become familiar with the curriculum materials developed in recent years. Teachers are aware of changes, and many are quite apprehensive about what effect the changes are going to have on them.
3. Most teachers will never be reached by the present National Science Foundation (NSF) institute programs. (Informal results of a recent survey of National Science Foundation participation in this State lead us to hypothesize that most married women with families—who represent many of our teachers—will not apply for NSF Summer or Academic Year Institutes.) Records of NSF participation of Idaho teachers from 1961–62 indicate that 2.9 percent of Idaho secondary school teachers participated, most of them in science institutes. The participation figure for elementary school teachers was a small fraction of 1 percent.
4. In order to improve mathematics instruction, local districts and county systems, in cooperation with State departments of education and the institutions of higher education, must assume responsibility for initiation of vigorous high-quality inservice education programs.
5. In order to staff the numerous inservice education programs that will be necessary to give all mathematics teachers the

opportunity to participate, key personnel from local and county systems who are recognized as quality teachers and who have high subject matter competence should be trained and utilized as instructors.

6. The State mathematics supervisor, in cooperation with the mathematics departments of the State's institutions of higher education, the U.S. Office of Education, and the National Council of Teachers of Mathematics, is providing the leadership in initiating a statewide inservice education program with the ultimate objective of providing training opportunities for every mathematics teacher in the State. The local districts should take the responsibility to utilize the trained personnel in further training of their own teachers. This responsibility is not to be taken lightly. The superintendent should be aware of the potential that the trained person represents and should be aggressive in instituting an inservice program.
7. Project Idaho is designed to supplement and build on the excellent opportunities that have been supported by the NSF. We must now shoulder the responsibility to give all our teachers the opportunity to increase their competence.

Listed below are some of the key personnel in Project Idaho:

Director

G. Richard Kay, *Mathematics Supervisor*, Idaho State Department of Education.

Consultants

Frank B. Allen, *President of National Council of Teachers of Mathematics.*

Kenneth E. Brown, *Specialist in Mathematics*, U.S. Office of Education.

Robert B. Davis, *Professor of Mathematics*, Syracuse University.

Merle Fisher, *Professor, Department of Mathematics and Physical Science*, Ricks College, Idaho.

Boyd Henry, *Head, Department of Mathematics*, College of Idaho.

Stanley Jencks, *Assistant Professor of Mathematics*, University of Utah.

Richard Mayer, *Head, Department of Mathematics*, Idaho State University.

Gerald S. Rogers, *Committee for Undergraduate Program in Mathematics*, University of Arizona.

Paul C. Rosenbloom, *Professor of Mathematics*, University of Minnesota.

Hans Sagan, *Head, Department of Mathematics*, University of Idaho.

Bill Smallwood, *Biologist, Science Department*, Mountain Home High School, Mountain Home, Idaho.

Joseph Spulnik, *Head, Department of Physical Science and Mathematics*, Boise Junior College.

Lauren G. Woodby, *Specialist in Mathematics*, U.S. Office of Education.

The Project has five phases:

Phase I

The State mathematics supervisor and a specialist in mathematics from the U.S. Office of Education held five 1-day regional conferences with administrators, supervisory personnel, and teachers. Consultants from our universities and colleges made presentations, as did one representative superintendent at each meeting. The purposes of these conferences, which were held during the week of February 3, 1963, were as follows:

To point out the need for inservice education for mathematics teachers.

To explain Phases III and IV of the Project Idaho with the objective of enlisting support.

To ask superintendents to make nominations of quality teachers to act as consultants, and to ask for an outline of a tentative inservice program in which to utilize these teachers.

Phase II

On March 28 and 29, 1963, a 2-day planning conference will be held in Boise. The purpose will be to plan the 2-week inservice program leadership conference that will be held in Boise in June. The conference participants will include the State mathematics supervisor; the Mathematics Department Heads from Idaho State College, University of Idaho, College of Idaho, Boise Junior College, and Ricks College; one mathematics consultant from the U.S. Office of Education; the President of the National Council of Teachers of Mathematics; some mathematics teachers on the State Advisory Committee in Mathematics; representative superintendents; and other consultants.

Phase III

The heart of Project Idaho is the idea that key mathematics teachers who are well grounded in their subject and who are very capable in the classroom can be trained to carry on effective inservice programs. Phase III provides a 2-week leadership conference for these teachers.

Although the details of the Leadership Conference will be worked out in Phase II, certain basic plans have been established.

The main lecturers for the conference should be the heads of the Mathematics Department of Idaho State College, University of Idaho, College of Idaho, and Ricks College.

Appropriate topics in mathematics should be included in the lecture schedule.

Leadership training for inservice work can be done mostly in seminars and discussion periods.

An outstanding mathematics educator should be utilized for two days. Max Beberman and Paul Rosenbloom are the top choices. Either of these special consultants should conduct demonstration classes.

A library of the latest publications on mathematics should be available.

The 2-week conference will be held at Boise Junior College. The subsistence costs for the conference should be paid by the local district; all other costs for the conference will be provided.

Phase IV

It is planned that all 24 of the key mathematics teachers will return to their local areas, and will initiate and carry out an inservice program for the local mathematics teachers. The local administration and trustees must be sold on the project, and must be willing to support it. It is our intention to use every available opportunity for leadership from the State department of education. Our budget provides for one visit of a mathematics lecturer for each inservice leader during 1963–64. This phase of the program is limited but it is conceivable that additional visits by local mathematicians might be financed through the Visiting Scientist Program of the Idaho Academy of Science or other organizations which are sponsoring such visits. The budget for the project is small, and success depends upon the support given the project by all who participate.

Phase V

Evaluation procedures will be discussed during the March planning conference. It is assumed that the State department of education can provide limited funds for evaluation and publication of results.

Illinois

Gussie Phillips
Mathematics Consultant
Office of the Superintendent of Public Instruction
Springfield, Ill.

The most notable feature of the Illinois Plan for Improvement of Instruction in Mathematics is a series of workshops for elementary teachers. The success of this inservice education program has been due largely to careful planning to meet the needs of the teachers by the Office of the Superintendent of Public Instruction, to ardent support from county superintendents and from the Illinois Council of Teachers of Mathematics, and to the enthusiasm of teachers.

The first suggestion for workshops was included in the report "The Teaching of Mathematics in Illinois," published in April 1958 after 3 years of intensive study by the Mathematics Study Group of the Planning Committee for the Allerton House Conference on Education in Illinois. In this report the Group recommended that clinics be held throughout the State for the purpose of helping teachers improve instruction in arithmetic. This Group felt that short meetings then already scheduled to be held by the Illinois Curriculum Program would partially satisfy this recommendation. These meetings were to introduce the Illinois Curriculum Program Bulletin Number Two, "Thinking in the Language of Mathematics," which was to be released in 1959. While these meetings did prove helpful, they were inadequate.

As interest in mathematics developed throughout the State, additional meetings of the Illinois Council of Teachers of Mathematics were planned in other areas of the State. Today, six well-attended sectional meetings are held each year.

In 1958 the passage of the National Defense Education Act made possible the appointment of State mathematics consultants, although no consultant was appointed until July 1, 1959.

With assurances of all possible support from county superintendents and from the Illinois Council of Teachers of Mathematics and the State universities, the Office of the Superintendent of Public Instruction decided to conduct some inservice workshops in mathematics. It was decided that these workshops should be for the elementary teachers, since most of the high school teachers were able to take advantage of the National Science Foundation Summer Institutes for secondary teachers. Two pilot programs were planned for the fall of 1959.

Each of these pilot workshops consisted of one 2-hour session a week for 8 weeks. A set of carefully selected library books was left at the host school during the 8 weeks so that teachers could do additional reading. Materials for the construction of two teaching aids were supplied to each participant at each session. At every meeting each participant also received a handbook unit containing class notes supplementing the leader's lecture and descriptions of activities and devices that would enrich classroom teaching. The eight units were assembled at the conclusion of the workshop to form a handbook which could be saved for reference.

The two pilot workshops were held at Quincy and Robinson. The units for these pilot programs were developed and assembled by Mrs. Gussie Phillips, who conducted the Robinson workshop, and by Mr. Houston Kirk and Mr. Robert O'Neal, who together conducted the Quincy workshop. Dr. Francis Brown from Illinois State Normal University and Dr. Joseph Stipanowich from Western Illinois University were available on a consultative basis.

Seventeen additional workshops were conducted by recognized leaders in all areas of the State during the second semester. These leaders, chosen from all grade levels, used essentially the same materials since it was decided to wait until summer to make any extensive revisions. The only major change was the inclusion of exercise and assignment sheets, which were for optional use by the workshop directors. Most of the directors were members of the Illinois Council of Teachers of Mathematics and the National Council of Teachers of Mathematics, with several directors associated with our State universities. Each of the leaders was asked to evaluate the materials carefully as the workshop progressed.

Teacher participants were asked to rate for teaching value the 17 activities or devices constructed in the pilot workshops. The five highest-ranked devices in order of teaching value were an open-end abacus made with styrofoam balls; a set of Napier's rods made of tongue depressors; a number scale made from adding-machine paper; fraction puzzles constructed from cardboard; and magic squares drawn on cardboard.

Evaluation sheets were also given to all workshop participants at the last meeting to help answer such questions as, how useful has the workshop been? how clear have the explanations been in the class lectures? how clear have the explanations been in the printed materials? are eight 2-hour sessions satisfactory? how useful have the enrichment materials been in the Activities and Devices Section at the end of each unit? should regular assignments be given from session to session? do you have any suggestions to offer?

As a result of these evaluations, it was decided to continue the eight 2-hour sessions, to include assignment sheets, and to discontinue making teaching aids in favor of spending more time on the lesson materials. It was at first assumed that elementary teachers would not be interested in lectures consisting only of brief explanations of activities, but would prefer to spend more time in a laboratory learning to make and use some of the teaching aids. While teachers expressed interest in the devices constructed, the majority preferred making them at home so that more time could be devoted to discussion.

These State-sponsored workshops are now an integral part of the Illinois Plan for the Improvement of Instruction in Mathematics under Title III, NDEA. The State Office works with the county offices in establishing these workshops. A workshop is usually requested by a county superintendent; however, one may be requested by a local superintendent if he sends a carbon copy of his letter to the county superintendent. The county superintendent helps determine the location and starting date of the workshop; the mathematics consultants in the Office of the Superintendent of Public Instruction interview possible workshop directors and see that all arrangements are completed. While no credit is given for these workshops, a certificate of attendance signed by the State superintendent is presented by the county superintendent to each participant who attends regularly.

Each workshop is planned to provide an overview of the "newer" thinking in mathematics by introducing teachers to the new approaches for presenting old topics and to the use of new topics in mathematics; to provide background information in mathematics which will help teachers understand and recognize the importance of the concepts they develop and how these concepts fit into the total program of elementary mathematics; to stimulate professional growth by encouraging teachers to read and study independently; to acquaint teachers with new library books and other enrichment materials; and to stimulate mathematical thinking. These workshops are not intended to be methods courses.

That the workshops have served these purposes can be judged from some of the reactions of participating teachers. A few comments taken from unsigned evaluation sheets of the participants are given.

> "It has certainly increased my awareness in reading current magazines and newspapers. Many illustrations have meaning for me now that would have meant nothing previously."
>
> "I feel that I have graduated from the educationally mentally handicapped mathematics class and can now proceed on my own."
>
> "This was the most stimulating 'class work' I have experienced in over 25 years."
>
> "This has been extremely valuable to me as a principal. I feel that I have a much better understanding of the terms and methods which are (or should be) in use in my school. Certainly I shall be of more help to my teachers in the future."

> "I have more confidence now and I am enjoying arithmetic with the children as I didn't previously. New methods become more meaningful."

There is little doubt that these workshops have helped elementary school teachers to feel more comfortable in the classrooms. Many teachers have expressed fear of a credit course offered by a college or a university but have eagerly enrolled in these workshop courses.

By July [illegible] 1963, a total of 138 State-sponsored workshops will have been held in 64 of the 102 counties in Illinois. The average cost of conducting the 110 workshops that have ended has been approximately $243 for each workshop. This average represents the following expenses for each workshop: supplies—$3; books—$13; salary of director—$215; and consultant help—$12. This average cost will decrease each semester, since there will no longer be expenditures for supplies and consultant help unless it is decided to revise the handbook again. The book expense will also diminish since the same library books will continue to be used. The $243 does not include the cost of the printed workshop handbook, which is distributed without charge to each participant. The cost of printing each handbook is approximately $1.00. If this cost were included, the average cost of each workshop would then be approximately $283.

Data on State-Sponsored Workshops

	Number of workshops conducted	Additional counties reached	Number of teachers enrolled	Average workshop enrollment
Fall 1960	2	2	52	26
Spring 1961	17	9	429	25
Fall 1961	31	14	1,025	33
Spring 1962	28	15	1,100	39
Fall 1962	32	14	1,345	42
Spring 1963	28	10	[1] 1,130	40
Total	138	64	5,081	

[1] Estimate.

Mathematics consultants in the Office of the Superintendent of Public Instruction (OSPI) have assisted local school districts in starting their own inservice education programs by helping them secure qualified directors and by working with these directors. The OSPI has also provided the mathematics handbooks for these workshops.

Data on Locally Sponsored Workshops

	Number of workshops	Number of counties	Number of teachers	Average enrollment
Fall 1961	1	1	8	8
Spring 1962	9	4	439	49
Summer 1962	2	2	100	50
Fall 1962	17	8	942	55
Spring 1963	25	11	1,146	46
Total	54	12	2,635	

As the demand for workshops increased, State colleges and universities were encouraged by the Office of the Superintendent of Public Instruction to offer a few 2-week and 3-week courses in addition to their regular summer offerings. During the summer of 1962, 11 courses were offered by 7 colleges and universities. Many of these were of the workshop type.

During this school year an additional 234 teachers used the handbook in courses offered in 7 junior colleges; and 400 teachers used the handbook in private school workshops. By the end of the year, more than 8,600 teachers will have been enrolled in inservice programs using the handbook "Number and Operation."

That more and more requests for workshops are received each semester is evidence that there is increasing interest in inservice education in mathematics. Additional evidence of interest is shown by increased enrollments in all workshops. During the past year the demand for entrance has made it necessary to limit enrollments.

A meeting with directors of university extension services was held in April 1962 to plan locations for State workshops and university extension courses so that more teachers and more areas of the State could benefit. This is another example of the degree of cooperation between the State Office and the State universities.

When the School Mathematics Study Group (SMSG) offices were moved from Yale University to Stanford University, Illinois requested some of the SMSG materials which were offered to the different States. Some secondary schools are now using these materials and conducting weekly and bimonthly meetings to discuss them.

Each year additional mathematics consultants and supervisors are being employed by local school districts. Consultants in several of these schools have conducted inservice education workshops, using in some cases new elementary program materials or new elementary textbooks, and in other cases, an assortment of all available materials and texts.

Inservice work by television

Because of content changes in arithmetic, elementary teachers now teaching are requesting help in geometry and measurement. A workshop in this area is being considered.

Workshops appear to be a step toward better teacher preparation for updating mathematics. Other steps must follow, since it now appears that a continuous change will characterize the mathematics programs of the future, and conscientious teachers will want to keep abreast of the new techniques and curricular trends.

Some exploratory work has been done with television in inservice mathematics education. This has been conducted mostly by private schools or organizations over local stations. WILL-TV started broadcasting February 14, 1963, over the Urbana closed-circuit system. For this series of telecasts, 15 half-hour films on New Methods in Elementary Arithmetic are being used. The films feature demonstration teaching by Mr. John Trivett, mathematics consultant for the King County schools in Washington. Lessons are telecast each Thursday at 3:45 p.m. and are received in each elementary school building in Urbana. Many teachers in Champaign are also attending and viewing these telecasts.

Last year two series of six 20-minute programs were televised on open circuit by DePaul University. These series were also for the general public. The demonstrations were presented by two professors from DePaul University, one from the physics department and one from the school of education. Several similar telecasts are tentatively being planned for next year.

Station WTTW, Channel 11 in Chicago, has offered several mathematics courses on open-circuit TV. These courses have been primarily in the fundamentals of mathematics for Chicago junior college students. Many of the students taking the courses were, however, enrolled in the pre-teaching curriculum. Tentative plans have been made jointly with Chicago Teachers College North to offer a course next fall in modern mathematics. The prime objective of this course will be to acquaint teachers and parents with the new mathematics and the methods currently being used in teaching arithmetic.

The Southwestern Indiana Educational Television Council in Evansville produced one 20-minute telecast for elementary teachers of arithmetic. This program was viewed also by schools in southeastern Illinois. Schools in this Council have requested more programs in mathematics, and some are being planned for next year.

During 1962–63 the Wisconsin School of the Air is presenting "Patterns in Arithmetic," a modern course of instruction for grades 4, 5, and 6. This program is being produced by the University of Wisconsin Station WHA–TV, in cooperation with the National Science Foundation. Two 15-minute programs are being telecast each week during this school year. The director of this project is Dr. Henry Van Engen, and the television instructor is Miss Marilyn Zweng. These telecasts are being received by many of the schools in northern Illinois.

The Tri-County Instructional Television Project is telecasting the film "Patterns in Arithmetic" over WTTW–Channel 11 for teachers in the counties of Cook, Lake, and DuPage. However, they are presenting it in a series of 12 half-hour telecasts.

Reports from Southern Illinois University (Carbondale), Northwestern University (Evanston), and KETC–Channel 9 (St. Louis) indicate that nothing has been offered during the past year in mathematics. Modern mathematics has been presented by Continental Classroom over several major channels.

Seven 30-minute telecasts presenting actual classroom demonstrations followed or preceded by a short panel discussion, were sponsored by the Office of the Superintendent of Public Instruction during 1961–63 and were telecast over WCIA in Champaign, WICS in Springfield, WSIU in Carbondale, and WREX in Rockford. These programs acquainted teachers and parents with contemporary mathematics by letting them view a typical class in action.

More may soon be done through the medium of television in Illinois. The School Problems Commission on December 19, 1962, voted approval of a proposal which is to go before the next session of the State legislature; the proposal is in the form of a bill requesting $6,500,000 for the next biennium for instruction and operation of a statewide system for instructional and educational television. The main features of this proposal include a channel for every classroom in Illinois on open-circuit TV; a microwave connection among 12 or more open-circuit locations and among the 6 State universities; and a 4-year construction and developmental period. The total cost of this project is set at $11,500,000.

If this bill is approved, inservice education will be listed as one of the 13 goals of the Illinois Advisory Committee on Educational

Television. However, while this will help alleviate the situation, it will not solve all the problems. It does appear that more and more help will be coming from local school districts. It also appears that preservice education requirements will be changed.

Maryland

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Philosophy of inservice education

Our philosophy of inservice education for mathematics teachers is one of concern for far more than the actual instruction of a number of teachers in a given situation. Our inservice education program is a far-reaching, deep-rooted, continuous program of improvement extending from the State department of education throughout all of the State's 24 local school systems (23 county systems and the Baltimore city school system). It is a program of cooperation between the State department and local personnel, and derives strength from the development of local leadership and initiative. It reaches beyond the actual work with teachers to the involvement of superintendents, supervisors, and principals, who must be continually aware of the need for change and improvement, so that they will provide a climate in which inservice programs flourish. While the total inservice education program is a cooperative State-local venture, the nature of some of its activities is such that they can best be developed and carried out on a statewide scale. Others lend themselves to a regional operation, and still others are best-suited to local implementation.

Program planning

Program planning within the State is a continuous, cooperative action by the Division of Instruction involving the director of the division, general supervisors of secondary and elementary schools and curriculum supervisors, as well as the supervisor concerned directly with science and mathematics instruction. State leadership in inservice education in mathematics has been enhanced by the National Defense Education Act and the development of new curriculum materials. The availability of funds for expanded activities by the State department of education and the acquisition of more equipment and materials of instruction at the local level have enlarged the scope of possible programs. The impact of new curriculums has focused attention on the need for inservice programs.

Planning sessions consider general directions for improving mathematics instruction, the type of programs desirable, local needs, local efforts, local personnel for coordinating arrangements, consultants and instructors, and available funds.

Inservice workshops

Workshops of three different kinds are considered desirable for local school systems:

> Orientation workshops—activities directed toward presenting overall ideas for new mathematics programs to teachers, supervisors, and administrators.
>
> Workshops on specific content, procedures, and methods of instruction—development and presentation of procedures for teaching specific content in elementary school arithmetic or in specialized mathematics courses.
>
> Workshops on development of courses of study—development of definite scope and sequence planning.

Workshop plans are developed cooperatively with administrative and supervisory personnel in local school systems. Because of location, size, and other factors, local school systems have different needs, and inservice programs are developed to satisfy local requirements.

Statewide or regional programs

State conferences for elementary and secondary school supervisory and administrative personnel provide opportunities for acquainting local supervisors and principals with new ideas and directions in mathematics education. Two 2-day conferences of this nature are held annually in the State, one for all elementary school principals and supervisors and one for all secondary school principals and supervisors. Such conferences are planned jointly by the local superintendents of schools and the State department of education.

The Maryland Conferences held in 1961 illustrate this point. The theme of the conference on elementary education was "Emerging Frontiers in Learning." One of the presentations was by Dr. E.

Glenadine Gibb of the State College of Iowa on the topic "Frontiers in Learning Mathematics." The conference on secondary education had as its theme "Emerging Trends in Education." The program of the mathematics section of the conference consisted of an address entitled "Emerging Trends in Mathematics," delivered by Dr. Howard F. Fehr, Head, Department of Mathematics, Teachers College, Columbia University.

Regional conferences, generally involving several local school systems, tend to be more specific in subject. As an example, a series of three 1-day sessions at two different locations in the State were held in 1959–60 in response to a request from a group of local school superintendents for some means of informing elementary school supervisors and principals of the recent trends in arithmetic—emphases, procedures, research, and materials of instruction. Representatives of 12 counties and a teachers college participated in the conferences. The general plan of each conference consisted of several presentations by mathematics specialists, with opportunities for audience questions and discussion. The following presentations were made at the three sessions:

"Emphases in Elementary Arithmetic," by DR. FOSTER GROSSNICKLE, Professor of Education, State Teachers College, Jersey City, N.J.

"Materials of Instruction in Mathematics for the Elementary School Program," by DR. MARY GRAU, Supervisor of Elementary Schools, Montgomery County, Md.

"Improving Arithmetic Teaching in the Elementary School," by DR. E. GLENADINE GIBB, State College of Iowa.

These conferences generated so much interest that the supervisors and administrators requested a workshop for teachers. The following summer, Dr. Marvin A. Volpel of the State Teachers College at Towson directed a workshop for 220 teachers from 6 counties in the area.

During the last 3 years, regional conferences have also been held for secondary school mathematics teachers and supervisors. These have generally taken the form of 2-hour evening programs with presentation and discussion periods. The general purpose has been orientation to new programs and ideas. Speakers for these programs have included Miss Veryl Schult, U.S. Office of Education; Mrs. Helen Garstens, University of Maryland Mathematics Project; Dr. John Brown, School Mathematics Study Group, University of Delaware; Dr. Daniel W. Snader, U.S. Office of Education; and Dr. Lauren G. Woodby, U.S. Office of Education. Conferences of this nature were held throughout the State. They were the result of cooperative planning, and each involved several local school systems.

State curriculum studies and guides have provided impetus and direction for inservice programs. The Report of the State Committee to Study the Maryland Public Secondary Schools, completed in 1962, contained a section on mathematics instruction. This section described a point of view, identified general trends in mathematics education and trends in specific courses, and suggested a number of scope and sequence programs. The "updating of the mathematical background of teachers through the assistance of NSF institutes and fellowships, local inservice courses and workshops" was cited as a significant trend. All local school systems had opportunities to contribute and to react to the materials during the development of the guides.

A similar curriculum study and guide are currently under development for the elementary schools.

A continuous flow of information on new developments and suggested improvements is maintained among the State department of education and local school systems. Such information, it is believed, can be significant in enabling local school personnel to make decisions on specific inservice programs. Newsletters and special publicity materials made reference to information contained in the following publications:

"Improving Science and Mathematics in American Schools," a Report of the Joint Commission on the Education of Teachers of Science and Mathematics, American Association for the Advancement of Science, and American Association of Colleges for Teacher Education—1960.

"Studies in Mathematics Education," a brief survey of improvement programs in school mathematics—Scott, Foresman Company, 1960.

"Science Education News," an issue devoted to reports of elementary science and mathematics improvement projects—American Association for the Advancement of Science, December 1962.

"Study Guides in Mathematics," Algebra, Geometry, Number Theory, Probability and Statistics—School Mathematics Study Group, 1962.

"The Revolution in School Mathematics—A Challenge for Administrators and Teachers," a report of regional orientation conferences in mathematics—National Council of Teachers of Mathematics, 1961.

A statewide, elementary mathematics, orientation workshop was developed by the State and a local school system, the Anne Arundel County system, in the summer of 1961. This 2-week workshop for local supervisors and principals was planned and financed jointly by the State department of education and the local school system. The superintendent and four representatives from each of the 23 other local school systems in the State were invited to join with participants from Anne Arundel County. This workshop involved a State-county steering committee, a local arrangements committee, and a local director, Dr. Carl Mauro, Supervisor of Elementary Schools in Anne Arundel County, who developed many of the ideas. The theme of the workshop was "What's New in Mathematical Ideas," and its purposes were as follows:

> To allow principals and supervisors a chance to hear of the latest information about new developments and experimental programs in elementary school mathematics from persons directly involved.
>
> To evaluate critically these latest developments for an expanding elementary school curriculum in terms of philosophy, psychology, materials, and teaching procedures.
>
> To stimulate those persons responsible for curricular changes and development to evaluate current programs seriously in terms of present and future needs.
>
> To give appropriate persons a general background for shaping future inservice training programs and curriculum development.
>
> To motivate persons to undertake action research projects of their own in order to develop new teaching materials and improve procedures.

Consultant-lecturers were as follows:

1 day—Dr. Rose Ginsberg, Stanford Project.
2 days—Dr. David Page, Illinois Project.
2 days—Dr. Bernard Gundlach, Greater Cleveland Project.
2 days—Dr. John Wagner, School Mathematics Study Group.
1 day—Dr. Ben Sueltz, New York State University, College of Education.
2 days—Dr. Robert Davis, Syracuse University, Madison Project.

The program provided for lecture presentations, demonstrations with children, and question-discussion periods.

During the last few summers, several regional 2-week workshops for teachers have been held simultaneously throughout the State. Such workshops have been financed by the State department of education and have been planned by the State and local school systems. In the summer of 1962, eight workshops were held in this program, seven for elementary school teachers and one for secondary school teachers. Approximately 750 teachers were involved in the eight workshops. Fourteen consultant-instructors directed the workshops, with local supervisors serving as administrative coordinators.

A typical program of the 2-week workshops for elementary school teachers would be conducted by teachers having experience with content, materials, and teaching procedures relating to the following types of topics:

Basic principles in teaching mathematics.
The number system.
Addition and subtraction of integers.
Multiplication and division of integers.
Laws governing operational procedures.
Measurement and simple geometry.
Common fractions.
Decimal fractions.
Rates, ratio.
Percentage.
Problem-solving.
Elementary set theory.
New topics in mathematics.
Materials and devices.

Some of these workshops were organized for teachers on a 1–6 grade basis, while others were organized for teachers of grades 1–2, 3–4, and 5–6 in three different locations. In general, most elementary school teachers in the participating local school systems attended.

The State department of education has assisted local school systems in encouraging teachers to apply for NSF institute programs by calling attention to opportunities, procedures, and deadlines for making application.

Regional television inservice programs have been developed by local systems with State assistance in planning and financing. Sixteen half-hour sessions were conducted for a four-county group of elementary school teachers in 1961–62, and is being repeated during the current school year. Telecasts are made over a local commercial station near the end of the school day. They are viewed by teachers in their schools and are followed by planned group discussions within the schools. Topics similar to those in the summer workshops are considered.

Inservice programs from educational television station WETA (Washington Education Television Association) provide service for some six counties in the Washington (D.C.) metropolitan area. During the current school year a program of contemporary mathematics is being produced weekly for 30 one-hour sessions. The time of the telecast is 3:30 to 4:30 p.m. on Mondays, with repeat programs on Wednesday at the same time and on Thursday evening. County use of this program varies and is somewhat limited. One county makes the program available to individual teachers on a voluntary basis, with two county meetings per month for follow-up and discussion.

Leadership for follow-up sessions is provided on a rotating basis by the teachers present. One other county group views the programs together and then spends another half-hour in discussions.

Local inservice programs

Some school systems provide six or more half-day sessions for inservice and curriculum work. The mathematics teachers of the local system meet regularly during this school-allotted time. Consultants are involved as needed. Regular afternoon or evening sessions are provided by some systems for special inservice courses.

Midyear conferences provide another phase of inservice activities. Many school systems provide for the closing of schools for 1 or 2 days, with opportunities for mathematics teachers to become better acquainted with new developments, new content, and new methods. Small counties with limited numbers of teachers have found it desirable to join with neighboring systems, arrange for simultaneous closing of schools, and provide inservice opportunities for mathematics teachers. Three counties, for example, planned together and involved all elementary school teachers in a program to improve the teaching of mathematics in grades 1–6.

Summer workshops for varying periods are arranged by local school systems for both elementary and secondary school teachers. One local program of this nature, in Anne Arundel County, established a 2-week workshop in August "to provide specific assistance to teachers in elementary mathematics." Ten different workshops presented a series of opportunities for the participants, including general sessions, and sessions on Cuisenaire Rods, geometry, signed numbers, metric measurement, exponents, Greater Cleveland Program Grade 1, other bases of numeration, grade-level seminars, and individual projects.

In addition to programs developed directly by local school systems, extension courses from the University of Maryland are brought to local centers. At least one county arranges for off-campus courses in mathematics for teachers and pays tuition costs for the teachers who participate. Local workshops are conducted throughout the school year on specific topics and courses such as calculus, general mathematics, and geometry. Local study groups are formed and meet after school hours, with rotating leadership from the group. Consultants are invited when needed. Resource teachers are employed to work with teachers in the classroom and make a significant contribution to inservice training. Visits by resource teachers can be followed by faculty meetings for evaluation purposes.

A mathematics curriculum laboratory established in an elementary school, in addition to containing learning materials for use by teachers with students in the school, provides a center for inservice education to acquaint teachers with the nature and use of the materials. It can likewise provide facilities for experimentation, group work, and exhibits. Such a center is of value to all professional personnel—teachers, principals, supervisors—as a resource room. Conferences and workshops are held there. The available materials, which enable principals and teachers to make better choices in the selection of supplies and books, are also a resource for action research studies.

New York

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During the last few years the New York State education department has sponsored a number of different programs of inservice training of teachers. These programs have been in science, foreign languages, and education of the talented, as well as mathematics. In this paper I shall describe the major features of the mathematics program. Many different units of the New York State education department have been involved in the administration of inservice training programs. In particular, the Divisions of Higher Education and Communication have been responsible for setting up most of them. The Mathematics Unit has acted in an advisory capacity for some of these programs and has had primary responsibility for others.

The regional program for elementary teachers

At 30 centers, located in public schools about the State, free instruction in mathematics is being offered to elementary school teachers. The course offered at these centers is for a full year of 30 weekly class meetings of 2 hours each. The instructors, who are employed by the State, were required to attend a 23-day workshop during the previous summer, at which the plans for the full year were made. The instructors were paid $25 per day for the 23-day workshop, and are paid a like amount for each of the 30 days of class meetings. This is the second year for this program and the total attendance to date is 3,200 elementary school teachers. This course is supported in part by Title III, NDEA, funds and it carries no formal credit. If the budget permits, this program will be expanded to 45 centers next year.

The course of study is the same in all centers. It emphasizes the logical development of the structure of our number system and the understanding of the principles underlying the common algorithms. An attempt is made to give the teacher ideas she can use directly with her students as well as to increase her general background in mathematics.

Collegiate year institutes and summer institutes

During the summer of 1962, 11 collegiate institutes in mathematics for elementary school teachers were supported by New York State, and 9 full-year institutes are being currently supported. These operate somewhat like National Science Foundation (NSF) institutes in that colleges and universities are encouraged to submit plans for such programs and a number of these are selected for State sponsorship. Since the plans are made locally, instruction varies from school to school. The financial support for these institutes is entirely by the State, and college credit is granted for these courses. The teachers enrolled have their tuitions, fees, and expenses paid, but no stipends are available. This program, which has been in operation for several years, has involved both elementary and secondary teachers although the recent tendency has been to concentrate in the elementary area. The reason is that since opportunities for secondary teachers to attend NSF institutes have been relatively great, it was felt that the State could serve best by concentrating on offerings for elementary teachers.

Advanced placement workshops

A 6-week workshop for teachers of advanced placement mathematics has been held at Colgate University during each of the past two summers. These workshops were specifically designed to prepare teachers to teach the advanced placement course (calculus and analytic geometry) on which the College Entrance Examination Board bases its examination. Two such workshops at Colgate and Yeshiva universities are planned for the summer of 1963.

The tuition, fees, and board and room of each participant are paid by the State. The material is organized in two related courses entitled "Concepts of Calculus" and "Methods and Application of Calculus." These courses carry 3 units of college credit each. (For further details of this program, see the *American Mathematical Monthly*, January 1963, page 88.)

Special courses for supervisors and assistant principals of elementary schools of New York City

A special course in mathematics for elementary school supervisors and assistant principals of New York City has been taught under State sponsorship at Teachers College, Columbia University, for the past 2 years. The expenses of this course are paid from Title III, NDEA, funds; the instructor is employed by the State, and no college credit is offered. The intent of the course is to increase the general mathematics background of these key people as well as to acquaint them with the various "modern" programs in elementary mathematics.

Computer mathematics

This year the New York State education department is sponsoring free instruction in computer mathematics for high school teachers of mathematics at Columbia University, the University of Buffalo, the University of Rochester, and Syracuse University. The stated objectives of the course are to provide an opportunity to understand the role of computers in mathematics and mathematics education, to provide instruction in some areas of numerical analysis applicable to computers, and to provide some skill as a programer in both machine language and some symbolic language. This course meets weekly for 30 weeks and operates on a combination laboratory-and-classroom-instruction basis. Ample computer time is available for each student to prepare and test various programs.

The filmed course "Mathematics for Teachers"

In 1957–58 a full year's course of 89 half-hour lectures in "Modern Mathematics" by Harry Ruderman was televised in New York City under State sponsorship. Kinescope recordings were made of this series and were later broadcast in Albany and Rochester, and in Erie, Pa. These 16 millimeter sound films have since been shown at various centers in the State, where mathematics teachers assemble to view and discuss the films. A complete set of lecture notes has been prepared, and is furnished free to teachers viewing the films.

These films have proved an excellent means of inservice education for senior high school teachers who have a relatively strong mathematical background. Several sets of copies of these films have been furnished at cost to education departments of other States.

Other television courses

Two other inservice courses in mathematics for teachers have been prepared at State expense and broadcast in some parts of the State. One of these is a course of 30 half-hour lessons for junior high school teachers; the other is a course of 36 lessons for elementary school teachers. Tapes of these are in the possession of the State and are available free to television stations. It is planned to convert these tapes to 16 millimeter film so that they can be more readily viewed in projected form by teachers.

Mathematics club of the air

About 20 half-hour films based on "club topics" in mathematics resulted as a by-product of a television series produced in New York City last year. The films of this series were planned by George Grossman, who was Coordinator of Mathematics for the City Board of Education. Financial support was furnished by the State. In these films, 15 chairmen of mathematics departments from New York City high schools present lessons on various "modern" topics. The content of each film is independent of that of the others, and the films can therefore be used singly or in any order. These films are available free to schools in the State, and have proved very useful both for inservice instruction of teachers and for instruction of capable high school students.

Pennsylvania

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In Pennsylvania we have had considerable success with our NDEA Title III inservice program in all areas, including mathematics. This program, under the direction of Dr. Lee E. Boyer, has been growing steadily since its inception, and has been favorably received in all sections of the State. There are two types of programs, introduced at the suggestion of Dr. Charles H. Boehm, Superintendent of Public

Instruction. Phase A is a general education program scheduled to be offered over a 2-year period. Phase B consists of programs designed to help teachers present science, mathematics, and modern foreign languages; these programs emphasize both content and teaching techniques. Phase A received priority during the school year 1959–60, and was designed mainly for elementary school teachers. Phase B was designed to follow Phase A for most elementary teachers and to be the beginning phase for secondary teachers. Both Phase A and Phase B programs are still being offered, although the demand for Phase A should show a diminishing trend while the demand for Phase B should increase.

The State is divided into 13 Area Curriculum Centers, strategically located, in each of which there is a chairman. These chairmen constitute an advisory body to the Department of Public Instruction for the inservice program. In addition to their advisory capacity, these chairmen serve as key people in their respective areas to explain the program and assist in organizing regional groups of teachers for instructional purposes.

Phase A

Phase A provides for regional meetings at various locations in the State to give teachers an overall appreciation of modern science. This will be accomplished through a study of great ideas in the development of science. Emphasis will be placed on discoveries made during the last 25 years. Materials on astronomy, geology, meteorology, physical geography, physics, chemistry, and mathematics will be presented.

Since Phase A programs rely heavily on demonstration-type lectures, 100 or more teachers can benefit from single presentations. It may be possible to hold these meetings in approximately 100 population centers of the State, so distributed that no elementary teachers need travel more than 1 hour to attend an inservice program.

Demonstration lecturers for these presentations will need to be enthusiastic scholars in their field and sensitive to the needs of elementary teachers. They may be recruited from universities, colleges, high schools, industry, or the State department's staff.

Length of an inservice program

Phase A sessions will be 1 hour long, and will be held at a time convenient for both the teachers and the instructor. An inservice program may be started in any month, and sessions may be spaced out over a time period convenient to both the teachers and the instructor, provided that the program does not last more than 10 months and that the sessions are not more than 3 weeks apart. It may be necessary to coordinate the meeting dates of adjoining regions so that an instructor can travel from one program center to another in a short time. The number of sessions may vary; 9 to 18 sessions would be desirable.

Necessary enrollment

No specific number can be set as the minimum enrollment necessary to justify a program because the density of population varies from one region of the State to another. The Department will be guided in its approval of prospective programs by the percentage of elementary teachers in the region that the chairman states will attend the sessions.

Financial support

The State department of public instruction will furnish instructors for inservice programs. The regional district (or cooperating districts) will furnish the physical facilities (classrooms and laboratories).

Program application forms

The Coordinator of Inservice Programs will provide an application form to any prospective regional chairman who is willing to organize an inservice program. The form will provide space to indicate the (1) kind of program desired, including the estimated number of sessions; (2) estimated number of teachers who will enroll in the program as indicated by teachers' responses and the percentage this number is of the total number of elementary teachers in the proposed program region; (3) names and addresses of persons who will assume responsibilities for regional arrangements; (4) place of meeting; (5) estimated cost of laboratory supplies.

The regional inservice program chairman

The Regional Inservice Chairman will be responsible for the following activities:

1. Serving as liaison agent between the regional groups and the Department of Public Instruction.

2

2. Obtaining information from teachers on inservice programs they desire.
3. Determining how many teachers will enroll in a given program and whether the cooperating districts (if any) would be willing to assume their prorated share of the cost of rentals and laboratory supplies; the regional chairman will assist the treasurer of the district in providing the physical facilities, and in receiving and disbursing whatever funds are necessary for the physical operation of this program.
4. Arranging for classrooms and laboratory facilities.
5. Determining the rental cost of physical facilities, if any.
6. Assisting the district furnishing physical facilities to allocate the rental cost (if any) among the several cooperating school districts (if any) on a prorated basis.
7. Suggesting names of possible instructors; the State department's list of qualified instructors who have indicated an interest in the inservice program will provide names of possible additional instructors.
8. Securing an Application Form for Inservice Program from the Department and sending to the Department the information requested.
9. Planning with the Department's Coordinator of Inservice Programs for items peculiar to his particular inservice program.
10. Certifying to the Department that the instructor has held the scheduled number of sessions.

Content of instruction

Since these programs are designed for general education in science, the demonstration lectures will be based on astronomy, geology, meteorology, physical geography, physics, chemistry, and mathematics. Each Phase A inservice program will relate to as many of these fields as possible. It will be necessary to use several instructors for each program, with each instructor giving demonstration lectures in his special field. Outlines of the content for each demonstration lecture will be supplied by the instructor to the regional chairman and to the Coordinator of Inservice Programs, State department of public instruction. The content will be academically substantial but directly related to the interests and needs of the teachers enrolled in the program. It should be aimed at modernizing the content and improving instruction in science, mathematics, and modern foreign languages. The Department will provide instructors with suggested program outlines.

Program credit

No college credit can be given for inservice program instruction, nor can teacher certification credit be given. The inservice programs do not compete with regular college courses or college institute programs offering college credit. Whenever possible, inservice teachers should avail themselves of the opportunities offered in regular college programs.

Choosing instructors

The State department of public instruction will establish a list of names of qualified instructors for inservice programs. (The Department will be glad to receive recommendations for possible instructors from any interested individual.) After an inservice program has been organized, the Department will cooperate with the regional chairman to consider applicants for teaching the program. The final choice will be made by a State department committee comprised of the Coordinator of Inservice Programs, the Director of the Bureau of Curriculum Development, and other selected persons. The instructors will become members of the staff of the Department.

Instructor's salary

The salary for teaching will be set by the Department.

Meeting with instructors

Occasionally the Department's Coordinator of Inservice Programs may meet with instructors at some central point to discuss inservice programs. Travel expenses will be paid to the instructors for such trips.

Phase B

In Phase B programs, a great deal of teacher participation is expected in experimental and laboratory work as well as out-of-class activities. The programs are much like good "extension" work, and are planned for teachers who are not doing work at a regular college or at an institute (such as an NSF institute).

Length of an inservice program

Same as Phase A, except that each session will be 2 hours long.

Necessary enrollment

Same as Phase A.

Instructional staff

The instructional staff available for a Phase B inservice program will consist of a consultant and, if the enrollment is large, one or more advisers. The consultant is the "head" teacher, in charge of the overall instructional aspect of the program. The adviser is an assistant to the consultant, and will be in charge of a small discussion group formed from the large group.

A consultant's preparation might be scholarly expertise in the subject field, college teaching experience that would fit him for teaching public school teachers, a wholesome attitude toward public school teaching, willingness to adapt instruction to the needs and interests of public school teachers, and an enthusiasm for teaching. An adviser's preparation might be a master's degree in the subject field, satisfactory completion of a 6-week or academic-year institute, or recognized "outstanding ability" as an elementary or secondary teacher.

Financial support

Same as Phase A.

Bases for organizing programs

Individual inservice programs must be formed by teachers with similar teaching responsibilities. For example, it seems reasonable to assume that elementary teachers would form one group. Junior high school teachers and senior high school teachers would organize themselves on the basis of subject.

The need for flexibility of organization is recognized. In some situations, relatively large groups of elementary teachers can meet profitably with relatively large groups of secondary teachers. Sometimes secondary teachers of two or more subjects may wish to form a single inservice science program. At other times it may be highly advisable for secondary teachers of only one subject to enroll in the program. In all cases, the possibilities of helping the inservice teachers become more able teachers should be the deciding factor in grouping the teachers.

Conducting a large session

Whenever large groups are enrolled in a program the consultant may wish to give a presentation to the entire group at the beginning of a period. Groups of approximately 15 to 20 could then be formed with an adviser in charge. Comments and questions raised in the small groups could be channeled by the adviser to the consultant for comment at an entire group assembly near the close of the session.

Content of instruction

The State department will furnish minimum program outlines, which will provide a basis for more detailed outlines to be developed by the instructor and the class members. As in Phase A, the content will be academically substantial but directly related to the interests and needs of the teachers enrolled in the program. It should be aimed at modernizing the content and improving instruction in science, mathematics, and modern foreign languages.

In Phase B programs, it is urged that a basic textbook, reference book, brochure, or mimeographed book be used. Assignments should be regular and should be challenging and satisfying. There is no substitute for active teacher participation. In some cases a great deal of practical laboratory work should be undertaken. Films may be used as a basis for class discussion and work. The State department owns six series of films on modern mathematics and two series on elementary science. Two or three of these films per session, supplemented by guided discussion by the instructor, could well become the basis for a course program.

In some cases the suggestion for providing basic text materials could be satisfied by having the inservice teachers accumulate a notebook as they progress through the program.

The important thing is that teachers have some type of regular study and work assignments, so that when the program ends, they will have a feeling of accomplishment.

Program credit

Same as for Phase A.

Responsibilities of instructors for Phase B programs

1. To cooperate fully with the State department of public instruction in carrying out the inservice program.
2. To provide the Department and the Regional Inservice Program Chairman with a general outline of the work covered and that proposed to be covered in the remaining meetings when half of the sessions have been held.
3. To organize the program to encompass a definite amount of out-of-class activity related to the teachers' professional development.
4. To use an evaluation outline, supplied by the Department, near the middle of the series of sessions (this evaluation outline is for the instructor's use only).
5. To provide substitute instructors if they cannot meet a session and to report the substitution to the State department and the regional administrator, or, if they cannot provide substitutes, to inform the Coordinator of Inservice Programs in the Department and the regional administrator.
6. To meet periodically with the teachers' class representatives and the regional administrator to consider problems related to the effectiveness of the program.
7. To keep an attendance record of each session.
8. To supply the regional chairman with a typed list of the names of the teachers enrolled.

Responsibilities of teachers enrolled in Phase B programs

1. To attend sessions regularly.
2. To provide themselves with the basic textbook and other materials recommended by the instructor.
3. To assist in the election of two class representatives who will meet periodically with the instructor and the regional chairman to provide guidance on how the program can meet the teachers' needs as closely as possible; at certain times the Department's Coordinator may attend these meetings; recom-

mendations made by the class representatives will be regarded as advisory.

Priorities for inservice programs

The State department will support as many inservice teacher education programs as the budget permits. If not all applications can be satisfied, they will be processed on the basis of the priority of elementary education, for the school year of 1959–60; earliest date of application; size of teacher enrollment; and geographic distribution.

Data on Pennsylvania's inservice programs for the first 4 years

Year	Total programs	Participants enrolled	Elementary mathematics	Secondary mathematics	Mathematics programs		Participants in mathematics	
					No.	Percent	No.	Percent
1959–60	34	5, 181	5	9	14	41	1, 144	22
1960–61	126	11, 374	9	30	39	31	2, 707	24
1961–62	96	7, 606	23	17	40	46	3, 173	42
1962–63	137	8, 003	33	28	61	45	3, 660	46
Total	393	32, 164	70	84	154	39	10, 684	33

The drop in the number of programs in 1961–62 was caused by a curtailment of funds. However, it is particularly gratifying to note a constant increase both in the number of those enrolled in the mathematics programs and in the percents of teachers participating in them.

The instructors for 80 percent or better of these programs were college or university instructors or people with an equivalent educational background. Salaries have been generally of such a magnitude that they paralleled the regular salary of the individual. Allowances for travel have been adequate, and special reimbursement has been made for particularly lengthy trips. The entire cost of salaries is paid by the State department of public instruction from equally matched Federal and State funds.

Reactions have been secured from interested students, instructors, and administrators. Most of these have been favorable, but perhaps the best recommendation lies in the continuing and increasing demand for these programs. The cost to date, $172,426, an average of about $439 per program, may prove one of the most fruitful of all the expenditures made to upgrade our educational procedures.

Some of the inservice programs offered in 1962–63 are "Modern Mathematics for Elementary Teachers," "Modern Mathematics for Primary Teachers," "Modern Mathematics for Intermediate Teachers," "Modern Elementary Mathematics," "Modern Concepts in Math for Elementary Grades," "Modern Math (SMSG) for Elementary Grades," "Modern Mathematics for Junior High School," "Modern Mathematics for Secondary Teachers," "Concepts in Modern Mathematics for Secondary Teachers," "Concepts in Modern Math for Secondary High School Teachers," "The New Math Programs in the Junior and Senior High School," "Secondary Mathematics (SMSG)," "(SMSG)-Matrix Algebra," "Updating Mathematics—New Look at the Old Math," "Computer Theory," and "Programing and Utilizing Digital Computers." The two latter have the use, respectively, of a General Precision LGP–30 Computer and an IBM 1620 Computer.

Although excellent use has been made of certain mathematics film series in some of these NDEA inservice programs, there has also been much use of films both by educational TV and in actual classroom use for teacher education. Among the series which found most use on TV were the Greater Cleveland "Elementary and Junior High Mathematics Film Series," and Pennsylvania's "Primary Concepts of Mathematics." In addition, much classroom use was made of the Philip S. Jones Series, "Understanding Numbers," and the Albert E. Meder Series, "Teacher Education in Mathematics."

There has been no attempt to make a distinction between the mathematics and science areas on television, but it is estimated that for these combined areas there were 1,382,150 children in the television classroom during the school year 1961–62. At the same time, approximately 80,245 families were viewing the program in their homes. These figures are approximately 50 percent greater than for the 1960–61 school year. Figures for the 1962–63 school year will not be available until the summer of 1963.

Certain districts, fortunately increasing in number, offer courses on their own or offer special inducements, such as released time, remuneration for expenses incurred, and salary increases, for teachers participating in inservice programs. In no inservice program, State-sponsored or district-sponsored, is there any attempt to compete with colleges and universities; rather, the aim is to meet specific needs not otherwise provided for. The district programs are not a State responsibility except insofar as their administrators request suggestions on NDEA assistance.

A recent inservice program is the Western Pennsylvania Project in the Use of Educational Television for Inservice Teacher Education in

Elementary Mathematics, presented over WQED in Pittsburgh and involving Allegheny, Armstrong, Beaver, and Butler county public schools in addition to the Pittsburgh public schools. There will be 16 half-hour lessons devoted to such topics as the number line, the four fundamental processes, visual materials, the equation, numeration systems, and various bases, geometry, and patterns. The programs are directed to key teachers, who will then teach other teachers in their areas. Informal evaluations of the program have revealed that some of the participants are satisfied with the level of difficulty, that others feel that nothing new is being presented, and that still others think the work is too difficult and is covered too rapidly. Suggestions that have been made are being incorporated into revisions of the presentation. If the program is successful, it may serve as a forerunner of other similar programs at varying levels.

One more inservice program, recently initiated, is intended to be used by small groups or individuals. In this program mathematics materials which have a modern approach and which are particularly appropriate for self-instruction have been made available. The only restrictions placed on their use are that they be returned in good condition and that a report be made indicating their effectiveness.

Available are programed materials, 16 mm. films, 35 mm. filmstrips, and tapes, which cannot be borrowed but can be duplicated for individuals who furnish their own tape for reproduction of the material. This individual approach should be an effective supplement to the larger-scale programs, since in many localities there are not enough people with a specific interest to justify a large-scale program.

Rhode Island

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The Rhode Island mathematics inservice program, sponsored by the State department of education, began in the 1961–62 school year. It closely followed these recommendations, made in a survey by Dr. Francis Mueller:

1. Each school system should initiate a formal review of its mathematics courses for grades 9, 10, 11, and 12.

2. Each school system should develop an inservice program for its mathematics teachers.
3. Each school system should recognize that State certification requirements represent minimum acceptable professional competence, not an ideally acceptable mode—and should set their own local standards accordingly.

Four inservice courses were offered that fall, three to teachers in the larger public school systems and one to teachers in the Providence Catholic Diocese. It was decided to use the School Mathematics Study Group materials because they were the most easily available and also because they contained good teacher manuals. Three algebra courses and one geometry course were offered. It soon became evident that some basic policies would be needed as guideposts for future inservice programs. Some of the basic philosophies set forth were as follows:

1. The instructor should be an outstanding secondary school teacher who has taught the subject matter for at least 2 years.
2. The instructor should concentrate on an understanding of the new terminology and techniques rather than completion of any required amount of subject matter.
3. The instructor should use his own teaching experiences with the new subject matter as a guide for the introduction of this material into the classroom.

Prospective policies for financing the inservice program were drawn up as follows:

1. For a community participating for the first time, the State would pay two-thirds of the instructor's salary and the community would pay the remaining third.
2. For a community participating for the second time, the State would pay one-third of the instructor's salary and the community would pay the rest.
3. In any successive inservice courses the State would assume responsibility for setting up the program, but the instructor's salary would be paid by the school system or systems participating.
4. The place of the meeting and janitorial services, would be the responsibility of the participating communities.
5 If several communities participated in an inservice course, the State consultant of mathematics would prorate the cost to

each community in accordance with the number of its teachers who were attending.

6. The time, place, instructor, and subject matter to be offered would be determined by the State consultant of mathematics education.
7. Two credits toward renewal of professional certification would be offered to those who complete the course. It was requested that communities which use course credits for pay increments recognize these courses for the purpose. This latter recommendation was accepted by all communities participating.
8. The course was to be composed of twelve 2½-hour sessions.

During the first year of inservice programs most of the instructors were from the Boston area; now, however, a sufficient number of our own teachers are capable of teaching the programs.

In the spring session of the 1961–62 school year 10 inservice courses were conducted throughout the State. These courses, together with the fall courses, were attended by 86.6 percent of the junior-senior high school teachers and also by teachers from many private schools. Thus, with the completion of the spring program, most private, public, and parochial school systems had begun the "retraining" of their teachers in the modern mathematics program. During this time, there were eight courses in School Mathematics Study Group (SMSG) Algebra, one in Geometry, and one in Junior High School Mathematics.

With the beginning of the spring courses the policy of having a "coffee break" was introduced; held after the first hour and a quarter of teaching, it accomplished two objectives: First, it gave the teachers an opportunity to relax and become better acquainted with teachers from neighboring communities, and, secondly, it gave them an opportunity to ask questions of the instructor and of their fellow teachers, questions they seemed to hesitate to ask during class. It became evident during "coffee breaks" that the teachers desired to proceed very slowly while they were "unlearning" and then toward the end of the course, to speed up. We still insisted that the instructor relate the subject matter to his own teaching experiences.

I think the success of the program demands a good deal of personal contact with teachers and superintendents to convince them of the need for change and the ease with which it can be accomplished. Favorable press releases and PTA talks seemed to be a necessary part of the persuasion process, which, in little Rhode Island, could be accomplished relatively quickly with a fairly high degree of success. Our greatest opposition, at the beginning, came mostly from high school mathematics teachers and in a few cases from parents; however, I believe this was the pattern across the country.

It was decided that the science inservice programs in 1962–63 would be given preference because of budget problems; however, the impetus of the previous year's mathematics inservice courses led to a demand for other mathematics programs. It was planned that the inservice courses would concentrate on the material for grades 4, 5, and 6, without change in the philosophy and policy of the previous year.

I believe that if you had asked me at that time how long I thought the transition from the traditional to the modern mathematics would take, I probably would have said it would be some 10 years before any appreciable change could be measured. This would have been predicated on the large number of elementary school teachers that would have to be retrained. This past year's inservice courses with 4th-, 5th-, and 6th-grade teachers have caused me to change my estimate. These teachers are eager to study the new methods and are quick to introduce them into their classes.

Whereas I had anticipated a long, difficult inservice program with elementary school teachers, it now appears that this will be the easiest and quickest to be accomplished. Much less of an "unlearning process" seems needed than for the senior-junior high school teachers, and the response of the elementary school teachers to "some good mathematics" has been a very pleasant surprise.

During the fall of the 1962–63 school year we had only four inservice courses—three in 4th-, 5th-, and 6th-grade mathematics and one in geometry. In the 4th-, 5th-, and 6th-grade materials we used three different texts. In the southern part of the State we used SMSG 4th-, 5th-, and 6th-grade material; in the center of the State we used "Number and Operation" of Mrs. Gussie Phillips of Illinois; in the northern part of the State, we used the Ball State materials. The spring of 1962–63 will have two 4th-, 5th-, and 6th-grade inservice courses, one in SMSG Geometry and one in data processing.

During the past 2 years, I have also conducted three short inservice courses in the use of the "Computer in Mathematics." These courses were planned to familiarize teachers with the use of desk computers for mathematics.

Plans for the 1963–64 school year are aimed at an even greater inservice program. If we receive the financial aid that we are hoping for, we will embark on a statewide program of inservice courses for teachers in grades K–6. The plans for this program call for six centers throughout the State, each under a center supervisor. The classes at each center would meet on Tuesdays and Thursdays. Tuesday classes will be for teachers in grades K–3, and will be attended by a teacher from each grade in every school. Thursday classes will be for teachers from grades 4, 5, and 6, and will be carried on along the same lines as the Tuesday classes. The program will be a large statewide undertaking; I feel that we now have the "know-how" and the personnel to undertake such a program. Preliminary inquiries from teachers and superintendents have indicated an eagerness and willingness to get started in this new program.

I have said in the past that Rhode Island, because of its small size and the close contacts of its teachers, could easily be a proving ground for the speed and success of introducing the new mathematics in grades K–12. We hope we are going to have the opportunity to operate this program during the coming school year, and I assure you that if we do, we will be able to answer questions for many other school systems.

I must add that we are also planning inservice courses in elementary functions and in probability and statistics for the secondary teachers, and I believe that there will be one or two inservice courses on data processing for the junior and senior high school teachers.

Credit should be given to the National Science Foundation for their summer institutes, inservice programs, and academic year institutes, the results of which are now being felt in the classroom. It is a pleasure to see the increase of summer institutes for elementary teachers. A factor that is helping the transition toward the modern mathematics is the number of good texts appearing on the market as a complete series for use from grades K–12.

I would like to list two effects of the inservice courses sponsored by the State department of education. The first has been changes in the mathematics curriculum of the colleges and junior colleges within the State. The discussion of what has been going on in the secondary and elementary school mathematics has caused them to evaluate their programs along the recommendations of the Committee on the Undergraduate Program in Mathematics (CUPM) of the Mathematical Association of America. The second effect has been the adoption throughout an entire school system of a modern mathematics program in grades K–9. This school system is holding inservice classes for teachers now to prepare them for the introduction of the new mathematics program next September. It is planned to have biweekly inservice classes during this first year, while the new material is being introduced.

In 1960 there were two experimental mathematics programs in the public schools of Rhode Island. Today, in 1963, there are only about two school systems that are *not* using some experimental mathematics.

In conclusion, I would say that the inservice education of the elementary school teachers will be accomplished much more easily and much faster than most educators had anticipated. The speed with which this is accomplished will depend a great deal upon the State supervisor, and will require personal contacts, encouragement, and planning.

Texas

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Long before the National Defense Education Act, Texas had one of the Nation's first State consultants in mathematics, who worked both with public schools and colleges in pioneering statewide inservice education for mathematics teachers. In recent years the school mathematics curriculum has undergone deep scrutiny by the Texas Mathematics Curriculum Commission (TMCC), composed of school administrators, representatives from industry, teachers of grades 1-12, and university and college mathematicians. One of its members was Dr. W. T. Guy, chairman of the mathematics department of The University of Texas and a representative of the Committee on the Undergraduate Program in Mathematics. The TMCC was influenced by such groups as the School Mathematics Study Group (SMSG), and its conclusions are now being reflected in textbooks and in a new, contemporary State curriculum in mathematics. The State's official course descriptions appear in Bulletin 615, *Principles and Standards for Accrediting Elementary and Secondary Schools and Description of Approved Courses, Grades 7–12.*

In the early fall of 1960, the first statewide inservice plans were written up as a project proposal by Ann Greer, consultant in modern foreign languages, and by me. These inservice plans were an outgrowth of the Mathematics Inservice Meeting at the U.S. Office of Education in March 1960, and the Meeting of State Supervisors of Foreign Languages in August 1960, also sponsored by the Office of Education. Programs in operation in Illinois and Pennsylvania were given close scrutiny in the development of the Texas Inservice Program. The proposal called for establishment of area centers across the State in which classes in mathematics, science, and modern foreign languages taught by chosen instructors within the area, would be open to all interested secondary school teachers within the area. The use of NDEA funds to carry on the program was basic in the planning. The project proposal was realized in 1962–63.

The "curtain raiser" for the vast program was a series of six regionally based "Area Conferences on Mathematics." These meetings, held in March and April 1962, were cosponsored by the Texas Education Agency and the Texas Association of School Administrators; they were strategically spaced, being held in Fort Worth, Big Spring, Canyon, Austin, Kingsville, and Huntsville. The 1-day meetings were designed to be somewhat like the Regional Orientation Conferences in Mathematics that had been sponsored by the National Council of Teachers of Mathematics and the National Science Foundation. The Texas Area Conferences were designed to bring to the attention of *all* of the State's mathematics teachers, supervisors, curriculum directors, and administrators strides in contemporary mathematics, implications of the new mathematics for the school curriculum, and the necessity for inservice reeducation of school staffs.

The six conferences played to sold-out houses. Alternating at the meetings were the keynote speakers: Frank B. Allen, Lyons Township High School, LaGrange, Ill. and Eugene Ferguson, Newton High School, Newtonville, Mass. They spoke of the nature of contemporary mathematics, school curriculum trends, and the impact of these two items for teacher education. Later in the day, group discussions of the situation in light of local issues were handled by members of the Texas Education Agency staff and some assistants from the Texas Council of Teachers of Mathematics.

The outgrowth of the conferences is an interesting and perhaps novel use of NDEA funds. The results have been a statewide inservice program in mathematics operating for the fall semester (1962) at two levels, much interest in curriculum improvement, purchase of improved text material, and a rather urgent demand for inservice improvement for teachers. A valuable aspect of this statewide program has been the cooperative involvement of the State department, NDEA funds, college mathematicians, and classroom teachers of mathematics.

In September 1962, the Texas Education Agency began to operate regional study groups, whose courses consisted of 18 clock hours of subject matter instruction in mathematics, physics, and modern foreign languages; two courses in mathematics were offered at each center. There were 18 study centers scattered about the State, and more than 1,600 teachers enrolled for the semester. In mathematics, instruction was oriented toward the effective teaching of mathematics at the seventh- and ninth-grade levels. Materials used were SMSG Mathematics for Junior High School (seventh grade) and SMSG Algebra. The courses have been taught by staff of the Texas Education Agency or by extremely well-prepared secondary school personnel who have been carefully screened for mathematical proficiency.

Although the use of SMSG course material for inservice work is not new, the use of visual aids built upon this course content is unique. By special arrangement with Dr. E. G. Begle and his staff, the Texas Education Agency has developed a series of transparencies for each of the courses being taught. These transparencies are shown on an overhead projector by the instructor. Aside from the instructional aid feature of these visuals, it has been found that their use allows the instructor to compress much more material into the allotted class time. The transparency sets are so complete that, in some cases, this medium was used to replace the chalkboard.

In the spring semester, beginning February 16, 1963, the Texas Education Agency is planning to operate classes in SMSG Geometry and SMSG eighth-grade mathematics on the same basis; a few centers will repeat the seventh-grade or algebra courses because of demand. In the spring semester the science course offered will be chemistry. The modern foreign language course, which gives much emphasis to the audio-lingual approach of teaching modern foreign languages, will be repeated.

In the fall of 1963, it is anticipated that mathematics instruction for elementary school teachers will be under way. Because there are about 40,000 elementary school teachers, the task is enormous. A plan for using self-instructing material for inservice education of elementary school teachers is under preparation. According to this plan, there will be several levels of study: the first will supply background in number systems, structure, and number properties for all elementary teachers; subsequent levels will train teachers in stronger content and new approaches at their respective grade levels. When completed, these materials will be supplied to every elementary school teacher in the State. There will be built-in lessons to be used by the teacher in the classroom at least once each week. The Texas Education Agency anticipates operating classes for teachers who use these materials only at the beginning and the close of the semester.

Coupled with this intense interest and progress in inservice education is another aspect of the curriculum in Texas. The textbook committee, which is charged with adopting textbooks for statewide use, has made a multiple selection of five textbooks for Algebra I, Geometry, and Algebra II, which will go into the classroom in September 1963. By the same procedures we expect to have new books for seventh- and eighth-grade mathematics in use in the classroom in September 1964. The following fall, we anticipate having new elementary school textbooks. In view of our textbook situation, mathematics inservice work for teachers of grades 1–12 has become very necessary.

The magnitude of the enrollment at the area centers for inservice education has surprised even those of us on the staff of the Texas Education Agency. The staffing problem for the centers has been gigantic, and the geographical distances between them contribute to the difficulty. Since these programs are based on new developments in subject matter areas, teachers are given a certificate of recognition for successful completion of the course. The Texas Education Agency hopes that local school officials will grant local credit for such inservice education. No college credit is given for the courses.

Each Area Study Course is administered without cost to local school participants as part of the Texas plan for strengthening instruction in science, mathematics, and modern foreign languages; in some cases a small fee is charged for the textbook and other instructional materials, which become the property of the participant. Financing of the Area Study Center is divided equally between NDEA funds and Texas Education Agency funds.

Participants and instructors were asked for an evaluation midway through the course. This procedure allows correction and improvement during progress of the course. The ideas and suggestions of the participants, instructors, and members of the staff of the Texas Education Agency are compiled at the close of the semester.

Participation in the Area Study Courses was made available to all interested schools in the State. Administrative procedures were handled by the Texas Education Agency. The larger school systems were given the opportunity for independent organization of a similar course, using materials furnished by the Texas Education Agency. At present there are 10 such local inservice programs in operation. These are underwritten with the same financial arrangement as the Area Study Courses.

Although the present outlook is most encouraging, a glimpse into the future reveals at least a 5- or 6-year program that will require great energy. We must prepare teachers to teach the material in new textbooks in order to achieve a program commensurate with suggestions in the recent Texas Education Agency Bulletin 620, *Mathematics, Grades 7–12.*

Virginia

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State Level

Credit courses

As a result of appropriations by the 1960 session of the General Assembly (Virginia's legislative body), the State board of education for the past 3 years has provided financial assistance to the local school divisions to help teachers become more proficient in their fields. The intent of this Act of the Assembly was to include all areas of the school curriculum; however, attention is drawn in this report to those activities concerning mathematics only.

To be eligible for any part of the appropriation, a local school division must determine the kind of class or classes that it would like to have. It then contacts one of the State-supported institutions of higher learning that has an extension division, viz., The College of William and Mary, The University of Virginia, or Virginia State College. To be considered for reimbursement, a class must be in content in mathematics, not in methods. For those teachers who enroll in an approved class and who meet certain requirements, a reimbursement of two-thirds of the cost of the course is available. In some instances, the local school division pays the entire cost; hence, reimbursement is made to the school division. No provision is made for travel, books, or other related expenses. A single division may be granted a maximum of two classes per semester, as long as funds are available. Statistics indicate that the number of requests has exceeded the amount of funds; consequently, some classes that had been anticipated could not be held.

For the school year 1960–61, 44 classes in mathematics with a total enrollment of 900 teachers, were conducted under this program; reimbursement from State funds was $23,200; for 1961–62, there were 54 classes, with 1,070 participants and State reimbursements of $28,190; for the first semester of 1962–63, 37 classes, with 828 participants and State reimbursements of $17,014. The total cost of these 37 classes in the first semester of 1962–63 was $30,217, of which it would seem that approximately $20,000 should have been reimbursed; however, some of the participants were lay people or teachers who did not qualify for reimbursement. In addition, it is of interest that the total amount allotted for the year 1963–64 is $200,000. Of this amount, $75,000 is to be put aside for State summer institutes in various subject areas.

Noncredit courses

The mathematics staff of the State board of education for 2 consecutive years has conducted numerous inservice programs in local school divisions on an informal, no-credit basis. This service is available, within the time and travel money available, to those localities that request it. Usually, two classes are held at each visit to a locality; one in the afternoon; the other, at night. This procedure enables a single staff person to reach as many teachers as space facilities allow at a single visit.

The basic guide, STUDIES IN MATHEMATICS, Vol. VI, "Number Systems," by the School Mathematics Study Group (SMSG), is liberally supplemented with pertinent mimeographed materials. Groups meet at 2-week intervals for a total of 6 to 8 sessions. In the interim, teachers meet regularly in small sessions to discuss the assigned content. At the general sessions, questions are answered and additional content which serves to enrich the specific topic is presented. For example, in the study of multiplication of whole numbers, many of the patterns found in the multiplication table are explored. These enrichment materials form a vital part of the work done at general sessions, and the staff is alert to gear these to the mathematical sophistication of a specific group of teachers. Note that the above mentioned guide is the *basic* one. For high school teachers it is necessary to use other curriculum materials and this has been done through the generous supply of SMSG texts which were granted to the State 2 years ago for use in inservice programs.

During the past 2 years the staff has been able to reach approximately 1,200 teachers through this activity. At least triple that number could have been reached with adequate travel funds on the State level.

Most of the localities have had to limit the number of teachers in this program to three or four from a school; however, each of these teachers has been charged with the responsibility of meeting with his or her co-teachers for the purpose of relaying as much information as possible to all members of a staff. This has worked very well as is evident by the improvement that has accrued to instruction in mathematics in the immediate past.

Summer institutes—credit

A part of the appropriations act of the 1960 General Assembly was designated for summer institutes in certain areas of the curriculum. In mathematics, these institutes were set up at State-supported colleges and were conducted similarly to those of the National Science Foundation (NSF); however, they have not been well attended because the stipend paid by the State is insufficient to allow many teachers to attend. Evaluation, however, reveals that the influence of participants has spread rapidly and effectively into the classrooms and to colleagues of participants. Through the auspices of the Visiting Lecture Program of the Mathematical Association of America, participants have had the opportunity to hear, and to work with for a day, some of the excellent mathematicians who have been sent to us at our request.

Local Level

Television

Through the Greater Washington Educational Television Association, a class in arithmetic content was set up and offered to teachers in the viewing area of Channel 26. This course has attracted a number of teachers in northern Virginia. Some school divisions have required their elementary teachers to view this course; others have encouraged it. Many teachers have taken it for credit under the Extension Division of the University of Virginia.

The Continental Classroom course, "Probability and Statistics," was presented over GWETA (via kinescope) to interested and talented high school students and to teachers. These kinescopes were used in connection with a study which SMSG is conducting in Virginia, a study to try to determine the best use of kinescopes in instruction. This course is used also through The University of Richmond and The College of William and Mary with teachers in service. (Those who would care to know more of this study may contact the writer, who is also the coordinator of the study.) Unfortunately, the hour at which the course was presented over GWETA was not conducive to a study of probability and statistics: 6:30 a.m.

Closed circuit

In the newly created city of Chesapeake, which embraces, among other localities, the former county of Norfolk, inservice education is offered to the primary teachers (grades 1–3) over closed-circuit television. The classes for these teachers are conducted by experienced teachers, who present content centered on the numeration system and its operations. The abacus is used freely in this activity, although many other teaching aids are utilized as they would be in the primary classroom. Demonstration classes are presented at intervals to reinforce the content already presented to the teachers.

In this locality, as in some others, released time is granted to *all* teachers for inservice work. For the high school mathematics teachers (grades 7–12), the local supervisor in charge of mathematics and science education conducts a class once a month for 2 hours, using the curriculum materials of SMSG and the University of Illinois Committee on School Mathematics as the focus. The purpose of this procedure is twofold: (1) to update teachers in knowledge of the content and point of view of contemporary mathematics, and (2) to prepare tentative outlines of courses in all areas of mathematics instruction to be used in formulating criteria for the local adoption of textbooks during the current spring. This practice (or an alternative version of it) is followed in all sections of the State and at all grade levels where local personnel is available to direct it. The impetus this year is the fact that all local school divisions will adopt mathematics textbooks for the period 1963–69. These will be chosen from a wide range of books adopted by the State board of education in December 1962.

A spot survey made recently reveals that there is hardly a single school, and there is no school division, that is not engaged on the high school level in this kind of inservice program in mathematics.

NSF inservice institutes

It is not known at this time how many inservice institutes sponsored by NSF are currently under way in Virginia; however, they do exist, and they are playing an important role in upgrading the mathematics content of teachers. May they continue!

Our most pressing needs

As viewed by the mathematics staff, the most pressing need at present is to secure a core of qualified persons to conduct inservice programs at the local level. The demand for such programs far exceeds the supply of these persons. Educational television helps, but there is desperate need to have a "live" teacher at hand to clarify and expand topics and concerns as they arise. It cannot be assumed that all teachers enter class with identical knowledge of, or interest in, mathematics. This is especially true at the elementary level. All too frequently, teachers are mistakenly assumed to be well-grounded in mathematics. At the outset, it is most important to allay fears of mathematics and then to present content at whatever level it can be assimilated.

How shall we meet this need? This is one of the questions to which I am seeking an answer during this conference.

Our second most pressing need is one that probably must be solved internally, namely, how to raise the money necessary to pay persons qualified to conduct inservice mathematics programs.

The future

Present inservice practices will probably continue and expand for a number of years; however, it is apparent that consideration must be given to practices such as the following: Computer programing as it relates to instruction, best use of new media for conveying knowledge, and content in mathematics for the 11-month school year.

Washington

Robert R. Willson
Supervisor, Mathematics Programs
Office of the State Superintendent of Public Instruction
Olympia, Wash.

The informal approach

Groups are formed at the local level to study the available professional, experimental, and commercial materials. The nucleus of such a group is usually a mathematics curriculum committee or textbook committee. Teachers from all levels of instruction from grades K–12, as well as the administration, have been represented in these study groups. The members collect and study textbooks and professional materials including those very fine publications of the National Council of Teachers of Mathematics (NCTM)—the *Yearbooks*, *Arithmetic Teacher*, and *Mathematics Teacher* magazines, and other publications. Members of the staff who have attended National

Science Foundation (NSF) or other institutes serve as resource persons and discussion leaders. The lists of NSF participants have proved useful in locating these leaders. The U.S. Office of Education publications such as Bulletin 29022, *Inservice Education of High School Mathematics Teachers*, contain much helpful information and many valuable suggestions.

Many variations of this "informal" approach are being used. In most instances it is possible for the school district to offer "professional" credit which is acceptable toward salary schedule requirements; however, college credit is not given. Examples of the informal approach include the following:

In the Seattle School District program, qualified junior high school mathematics teachers serve as consultants to elementary school teachers who are studying contemporary approaches to the teaching of arithmetic. This has proved highly successful. The junior high school teachers are specially selected both for their knowledge of mathematics and their understanding of the needs of the elementary school teachers.

Workshops for elementary school teachers in the Seattle School District are conducted prior to the opening of school each fall. These workshops are usually 3 days in length. Publishing company consultants often serve as leaders at workshops of this kind. Representatives of the outlying smaller school districts sometimes send members of their staff to these programs. For information on these and other inservice efforts being made in Seattle, I suggest that you contact Mr. Nick L. Massey, Director of Mathematics, Seattle Public Schools.

NDEA funds have been used to finance regional workshops and conferences which bring together teachers from many small school districts. Such a conference was held in Central Washington in August 1962, in cooperation with the Grant County Superintendent of Schools. More than 1,000 teachers participated. The keynote speaker was Dr. John Marks of San Jose State College. Demonstration lessons were taught by Mrs. Mildred Watt, Mt. Diablo School District, Concord, Calif. A similar conference was held in western Washington in February 1963, in cooperation with the curriculum director of Clallam and Jefferson counties. The consultants were Dr. T. S. Chihara, Seattle University, and James L. Hildebrand, Western Washington State College, Bellingham.

Mrs. Bernadine Condron, Consultant in Mathematics, Spokane School District No. 81, Spokane, Wash., heads a team of four consultants, who go to outlying schools to put on a 1-day workshop for teachers in elementary and secondary schools. These workshops are jointly sponsored by the County Superintendent's office and the State

Office of Public Instruction. NDEA Title III funds are used. Similar teams are being organized in other parts of the State. As a result of these 1-day workshops, study groups have been formed to continue the work initiated by the consultant team. This has occurred in both Stevens and Lincoln counties.

The formal approach

A more formal approach to the development of inservice training programs is the one which uses extension courses offered through teacher education institutions. College credit is given. Such courses are normally taught by college personnel, but quite often can be taught by local secondary school teachers who have been certified by the college offering the course.

A very fine example of such an approach is the Foundations of Arithmetic program developed by Professors Hacker, Long, and Barnes at Washington State University (WSU), Pullman. Under this program, which is now in its second year of operation, some of the secondary school mathematics teachers who are in attendance at the WSU–NSF Summer Institute attend a seminar where the Foundation of Arithmetic course is studied and problems pertaining to the elementary school are presented and discussed. Arrangements are made in advance with the school district for the secondary school teacher to offer the Foundation's course to elementary school teachers during the subsequent year. College credit is given and supervision of the program is provided by the WSU professors.

Such a program takes advantage of the fine help available from NSF Institute-trained secondary school personnel, and is one way of helping many more elementary school teachers become acquainted with the background material necessary to the teaching of an effective contemporary arithmetic program. For further information write to Dr. Sidney Hacker, Chairman, Department of Mathematics, WSU, Pullman, Wash.

During the 1961–62 school year, three such classes were given in the Tacoma school system and one in Clover Park. The program is being expanded this year, and outside financial help is being sought for this purpose. A brief outline of the course content follows:

1. Number, numerals, and arithmetic notation.
2. Structure of the number system and its axiomatic foundation.
3. Arithmetic as a formal model and the use of models in arithmetic.
4. Basic facts of geometry and their relation to arithmetic.

A similar program is available at the University of Washington under the direction of Professor Roy Dubisch. During the 1962–63 school year, 5 groups of about 15 secondary school teachers will have an opportunity to attend 3-day sessions of instruction designed to enable them to offer inservice education to their fellow teachers in their own school districts. For more information regarding this program, write to Dr. Roy Dubisch, Mathematics Department, University of Washington, Seattle. The program is supported by NSF. The University of Washington also offers Saturday institutes financed by NSF. These institutes are held on the campus or are available through the extension service in other parts of the State.

A variation of the extension course approach was used in Pasco School District No. 1 during the summer of 1962 when a month-long inservice program was conducted by consultant Justin Bardellini of San Francisco State College; he led about 12 selected teachers, one representing each grade, in a study and discussion of the philosophy and content of the new mathematics. The participants received a stipend for attendance, and the project was locally financed. It was anticipated that each teacher would return to his classroom and serve as a leader in putting some of this newly gained knowledge to work. Plans for following up this initial work are being developed. It is hoped that some outside financial help can be obtained for this phase of the program. Additional information can be obtained from Dr. James Thrasher, Superintendent, Pasco School District, Pasco, Wash.

The other teacher education institutions are also offering inservice courses. The demands for the services of college and university personnel continue to be more than they are able to meet. Members of the mathematics faculty of Western Washington State College, Bellingham, have taken part in a variety of short (1- to 2-day) conferences, workshops, and mathematics committee meetings, sponsored by school districts or by mathematics faculties in single schools.

During fall and winter quarters (1962–63) five school districts have been served by extension courses of either of two types:

1) Mathematics content—background for teachers who are or who will be using new content courses at the secondary and elementary level.
2) Review and critical examination of the various new programs at both secondary and elementary level.

Similar work is being done by both Central Washington State College in Ellensburg and Eastern Washington State College in Cheney.

Use of educational television (ETV) as an inservice education medium in mathematics

Although the mathematics educators from the colleges and universities are doing a superhuman job of providing inservice courses and answering requests for help on a personal basis, it is still physically impossible for them to meet all the demands. For this reason the use of ETV should be utilized as a means of expanding the work being done. Some very worthwhile efforts are now being made in the use of ETV for inservice education in mathematics.

One series of 16 half-hour videotape presentations for elementary school teachers was written and recorded during the summer of 1962 by Harold Cross of the Clover Park School District No. 400. This series is now being presented weekly over Clover Park ETV, Channel 56. Discussions are under way to determine whether it is advisable to make a negative kinescope film from the videotape so that 16 mm. positive prints could be made for use in areas not reached by ETV. For additional information, write to Mr. J. Albert Brevik, Director of TV Programing, Clover Park School District, 5214 Steilacoon Boulevard, Tacoma 99, Wash.

During the week of February 4–7, 1963, Dr. Edwina Deans, Specialist in Elementary Mathematics, U.S. Office of Education, made a series of 3 half-hour presentations at KCTS–TV, Channel 9, University of Washington. The presentations were recorded on videotape and a negative kinescope was made simultaneously. The material is directed to teachers of elementary school mathematics. We are looking forward to using the films in a variety of ways, and we know that they will be very valuable in helping us to bring the challenge of elementary school mathematics to many more teachers than we can reach in any other way. We plan to make positive prints of the films available at cost to those who are interested. Dr. Deans did an especially fine job in making the presentations, and we feel very fortunate in having been able to make use of her services in this manner.

KCTS–TV, Channel 9, University of Washington, is planning a series of 10 presentations by Dr. Carl Allendoerfer, beginning April 2, 1963. This series originated in answer to requests from parents for more information about what is happening in mathematics, but there are many possibilities for the use of the presentations. For example, we are encouraging teachers to organize viewer groups. The group would watch the program, then hold a discussion under a competent leader. A Viewer's Guide will be available which will help in the planning necessary for such a group discussion.

We are aware of many other efforts in addition to those described above. The State supervisor of mathematics has cooperated in the planning and production of several 1-, 2-, or 3-day regional workshops and conferences jointly sponsored by the State and county offices. The State supervisor also helped in the planning and publicity of the highly successful Northwest Regional Mathematics Conference held at Gearhart, Oregon, October 26–28, 1962. Plans are under way for a similar regional conference, to be held in the State of Washington in October 1963.

During the school year 1961–62 the State Advisory Committee on Mathematics produced a booklet entitled "Guidelines for Mathematics—Secondary," which has been distributed throughout the State, and is being used in a variety of ways for inservice education. The Committee is engaged in writing a similar book for the elementary schools. The "Guidelines for Mathematics—Elementary" should be ready for distribution before the opening of the 1962–63 school year.

Panel Reports on the Role of Professional Organizations and Governmental Agencies in Planning and Supporting Inservice Programs

The reports of the panel members were made during the morning session of the second day of the conference. A discussion period followed the oral presentations.

Shortened versions of the original speeches have been prepared by staff participants from the Office of Education.

"The Role of Professional Organizations and Governmental Agencies"

Dr. John R. Mayor
Director of Education
American Association for the Advancement of Science (AAAS)
Washington, D.C.

The most direct association of AAAS with inservice education for mathematics teachers is through the NASDTEC–AAAS Studies on Teacher Preparation (NASDTEC stands for the National Association of State Directors of Teacher Education and Certification). These studies involve scientists, mathematicians, and teachers throughout the country, working to develop a set of guidelines for the mathematical and scientific preparation of elementary school teachers. The guidelines' recommendations for mathematics are in very close agreement with those of the Mathematical Association of America's Committee on the Undergraduate Program in Mathematics (CUPM) for teachers of elementary school mathematics. Indeed, there has been an opportunity during the year to cooperate with the CUPM program of State conferences setting forth for college staff members of mathematics the CUPM program for the preparation in mathematics of elementary teachers. Dr. William P. Viall, associate director of the NASDTEC–AAAS studies, has appeared on a number of these programs of the CUPM. The CUPM, in turn, has cooperated with the NASDTEC–AAAS studies in providing travel costs for mathematicians to participate in the regional and national conferences.

During the academic year 1961–62, AAAS sponsored a pilot program on the use of special teachers in mathematics in grades 4, 5, and 6. The program was carried out in school systems in the Washington, D.C., Baltimore, Md., and Wilmington, Del., areas. The schools used the mathematics materials of the School Mathematics Study Group for these grades. One of the purposes of the pilot study was to determine the inservice needs of teachers, either as special teachers of mathematics or as teachers of self-contained classrooms. Consultant service was provided by Professor John A. Brown of the University of Delaware and Miss Mildred Cole of the University of Maryland. The consultants met with the teachers every other week during the first semester and less frequently during the second semester. Supervisors and helping teachers within the school systems also assisted in the inservice programs.

In providing such inservice opportunities, particularly in metropolitan centers, it is important that the school programs and these additional opportunities be closely coordinated. This is pertinent to the discussion of this panel because all of the agencies represented are providing inservice opportunities.

"The Role of the Conference Board of the Mathematical Sciences"

Dr. Leon W. Cohen
Executive Secretary
Conference Board of the Mathematical Sciences (CBMS)
Washington, D.C.

From just before the beginning of this century the effort to develop research mathematics engaged the American Mathematical Society. Since so little research had been done at that time, the Society devoted itself entirely to the problem of bringing research up to a level of international recognition. As a result, the instructional problems in the colleges received no attention, and those members of the Society who were engaged in undergraduate mathematics soon found that they needed an organization of their own. Hence they established the Mathematical Association of America. Then for various special purposes, other mathematical organizations were formed, including the Institute of Mathematical Statistics, the Society for Industrial and Applied Mathematics, the Association for Symbolic Logic, the National Council of Teachers of Mathematics, and our latest member, the Association for Computing Machines. It is quite clear from the titles of these organizations what special mathematical interests led to their formation.

During the period 1940 to 1950, under the pressure of the great wars and the magnitude of the technological consequences of science and mathematics, it became clear that this process of forming more and more organizations had to be reversed. A couple of years ago, out of the Policy Committee for Mathematics there emerged the Conference Board of the Mathematical Sciences. The purpose is to give some institutional effectiveness to the actual mathematical interaction between the special requirements of these various fields. In their early development it had been special interests which led to their origin. In the later developments it became perfectly clear that mathematics is a sort of seamless cloak, and while you may distribute emphasis in one direction or another, you still remain part of the mathematical community. At present, an effort is being made to give this common set of interests some expression through the Conference Board.

How does this relate to the problems of inservice education? It took a long time for the mathematicians to notice that the level reached by mathematics at the top (if you call the top the research level) depends on the level at which it starts at the bottom (if you want to call the bottom the place where young people first get their views of mathematics). Regardless of specialty—all specialties benefit if the start is right. Consequently, the preparation of teachers is becoming more and more a matter of active concern to people at every level in mathematics.

Inservice education is very similar to the kind of voluntary noncredit seminar which develops in an active graduate department of mathematics, where the faculty and the most advanced students participate in an analysis of current literature in special fields. Just as the noncredit seminar in the graduate departments is an established tradition, the inservice activities of teachers of mathematics will also be a continuing activity.

"The Role of Professional Organizations"

Bruce E. Meserve
Department of Mathematics
Montclair State College
Upper Montclair, N.J.

The Mathematical Association of America (MAA) has an important role in helping its members to gain a better understanding of the mathematical needs of elementary and secondary school teachers and to work effectively with teachers in improving their mathematical background. The MAA is trying to meet these responsibilities through the activities of:

(a) the Teacher Training Panel
(b) The Committee on Institutes
(c) the Committee on Secondary School Lecturers
(d) the relatively new Committee on Educational Media, which is concerned with films, television, programed texts, teaching machines, and other nonconventional media.

The Teacher Training Panel recognizes that its efforts to improve the preservice training of teachers through the preparation of guidelines and course outlines has implications for inservice training. The Level I regional conferences held to develop a consensus on the guidelines are providing an opportunity for concerned people to coordinate their efforts and goals for improving the mathematical training of elementary schoolteachers.

The MAA contest provides inservice teachers with opportunities for challenging high school students and evaluating the effectiveness of their own work relative to that of their colleagues in other schools.

We have made considerable progress in the last decade in:

(a) alerting capable school teachers, college instructors, and research mathematicians to the needs of teachers;
(b) improving the climate of cooperation (even though not all well-intentioned efforts have been effective: indeed difficulties of communication among persons teaching at different levels have been recognized in our discussions here);
(c) striving to improve the supply of professionally capable people.

Our dissatisfaction with our progress to date on these matters is a measure of our concern for them.

A few other activities of professional organizations illustrate commendable roles in inservice education. The Metropolitan section of the MAA has a high school lecturer program. The funds are secured from a grant through the Academy of Sciences program. The New Jersey section of the MAA cooperates in this program.

The Association of Mathematics Teachers of New Jersey cooperates with the State department of education in bringing programs to teachers. NDEA funds are used to enable the Association to broaden the scope of its meetings. Later this month we shall include special meetings for school administrators at the annual meeting of the Association. Speakers and publicity to administrators will be provided through NDEA funds. NDEA funds also enable the Association to expand the geographical coverage of the State by having more meetings scattered throughout the State.

In conclusion, the Mathematical Association of America's Teacher Training Panel has cooperated with the National Association of State Directors of Teacher Education and Certification in several ways. There is some basis for thinking that this has helped the cause of mathematics in the study going on under AAAS sponsorship supported by Carnegie Corporation funds and involving standards for certification of teachers in mathematics and science.

"The Role of the National Aeronautics and Space Administration"

JAMES V. BERNARDO
Deputy Director
Office of Educational Programs and Services, NASA
Washington, D.C.

We live in the Space Age. The exploration of space by man is probably the most challenging assignment ever awarded to the American scientific, engineering, and industrial community. The great rate of change in our patterns of working and living induced by tremendous research and development activities is the dominant characteristic of the Space Age.

In the early 1930's, there was a move afoot to eliminate mathematics from the high school curriculum and to substitute for traditional courses the so-called practical mathematics. Needless to say, things have changed. As we have moved in the last few years toward reaching the national goal of a stronger educational program, improved mathematics education has changed from just a hope to a reality, indeed an imperative. We have the new mathematics curricula, at all age and grade levels—up to college.

But one of the most important elements, which, in my view, is sometimes overlooked in the national effort to produce more mathematicians, engineers, and men and women with some expertise in mathematics is the pedagogical principle of motivation. Unless a teacher can motivate, only a few of the naturally interested and talented students emerge from the pack to go on to careers in mathematics and science, and even fewer of the total do much more than satisfy minimum academic requirements.

I recall the comments made recently by one of the great scientists in the NASA. He was asked, "What caused you to go into your present profession?" His answer was, "I was motivated and stimulated by two teachers—one in chemistry and the other in mathematics. Both of them went beyond the textbook and the course outline to introduce real and exciting applications of the scientific and mathematical principles being taught."

We feel, in the Office of Educational Programs and Services of the NASA, that the incorporation of space-related facts and mathematical functions can serve the purpose of motivating and stimulating students and, at the same time, contribute toward the goals of excellence in teaching, excellence in technical education, and excellence in learning. I believe we should keep in mind that we cannot talk of excellence when there is no provision for the *attraction* of *excellence.* We should make use of community and national resources. We should provide opportunities for students to engage in worthwhile, meaningful activities and discussions. If we provide the climate and the atmosphere for creative thinking and doing, we make an invaluable contribution. The national space effort places a premium on original thinking, innovation, and creative work.

There is much useful material available to help you who man the command posts of our inservice teacher education effort in mathematics. The NASA has an educational service program, which can provide films, publications, Spacemobile presentations (the Spacemobile is a traveling space science lecture-demonstration unit that goes to schools and colleges upon request), and many other teacher and student aids. Many of you are probably already receiving, through the National Science Teachers Association (NSTA) and the National Council of Teachers of Mathematics (NCTM), our Fact Sheets. These are bulletin board eight-panel posters on each important space experiment as it happens, or before it happens.

Through our Educational Services Branch, we are dovetailing efforts with those of the U.S. Office of Education and other government agencies in a cooperative approach to help mathematics and science teachers. We provide resource people and equipment to workshops, seminars, institutes, and conferences designed for teachers in service. In the Science Teaching Exploring for excellence Program Steps (STEPS) of the U.S. Office of Education, we are assisting pilot projects in selected States for the development of materials of instruction and programs for the upgrading of elementary and secondary school mathematics and science teachers.

We are also making possible the gathering of small groups of mathematics teachers in college aerospace workshop activities in an effort to develop classroom mathematics materials for enrichment and motivational purposes.

Whatever the schools may or may not do to meet the needs of technology, our children will be increasingly exposed to space activities by the newspapers, television, radio, and word of mouth. But only through an orderly and organized experience can they acquire the understanding of the forces involved and the motivation to participate in their creation and operation. Providing this orderly experience is the challenge to the schools, particularly to the mathematics and science teachers.

The late President Kennedy said: "Space science, like nuclear science and all technology, has no conscience of its own. Whether it will become a force for good or ill depends on man, and only if the United States occupies a position of pre-eminence, can we help decide whether this new ocean will be a sea of peace or a new and terrifying theater of war . . . .

"Our leadership in science and industry, our hopes for peace and security, our obligations to ourselves as well as others, all require us to make this effort, to solve these mysteries, to solve them for the good of all men, and to become the world's leading space-faring nation."

Let's do all we can to accomplish this goal. Our destiny is still in our hands. Let's accept the real challenge to see that this destiny be as great in the future as it has been in the past.

"The Role of the National Council of Teachers of Mathematics"

Frank B. Allen, *President*
National Council of Teachers of Mathematics (NCTM)
Lyons Township High School and Junior College
La Grange, Ill.

One of the reasons for my interest in this conference was to learn what the role of the National Council of Teachers of Mathematics should be. Once that role is defined, it is my function, as president of the Council, to provide for executive action. May I speculate with you about several things that the Council should do, and could do?

We can serve as a focal point to promote cooperation among various groups that are concerned with inservice education for teachers of mathematics. We can promote conferences of this type jointly sponsored with another organization. Membership on the Conference Board of Mathematical Sciences permits us to work also in coordinating operations. With almost 50,000 members, the NCTM is the largest mathematical organization in the world and therefore has access to the mathematics teachers of America to a greater degree than any other organization. Through our meetings and through our journals, we have established ourselves over the years as the organization to whom the teachers and administrators look for advice. Consequently, we can disseminate information effectively and this can be focused upon the problem of inservice education.

The Council may be able to take positive action in the field of inservice education by setting up descriptions or criteria which can be applied in determining whether or not a given type of inservice program is likely to be effective. The Council may have a related task to perform which is hard to define and even harder to perform, and that is the matter of policing certain situations. There are a number of self-appointed curriculum experts operating inservice education programs who are not qualified to do this. Perhaps the Council has a role to play with respect to these.

We have another project of the coordinating type. The School Mathematics Study Group (SMSG), the Mathematical Association of America (MAA), and NCTM have recently sponsored an Interim Central Coordinating Committee on Films and Television. Its purpose is to establish a film center which will serve as a clearinghouse for facts and information on the many mathematical films that have been produced. Then when a group proposes to produce a series of

30 half-hour films for the inservice education of mathematics teachers, as some are now proposing, information on those already available could be easily obtained. If this central committee is successful in establishing a film center, it will render a very real service. The chairman of our advisory committee on films is in charge of the film-producing part of the Committee on Educational Media of the MAA and at the same time is chairman of our coordinating committee, so that coordination is being achieved by the simple process of having a common element in all three of these fields.

Among the things that ought not be done is to regard the Council as a source of funds. Although the financial status of the organization is excellent, it does not seek projects to receive financial support. A grant was made to the Idaho project because it was a pilot project that offered a promising plan for promoting effective inservice education on a statewide basis. The amount of money involved was slight.

So the Council can be a catalytic agent, it can serve as a focal point for all those interested in this great problem of inservice education for mathematics teachers, and it can coordinate the efforts of people engaged in this work. When the role of the Council becomes more clearly defined, the necessary action will be brought to the attention of its Board, so that constructive steps can be quickly taken.

"The Role of the National Science Foundation"

C. Russell Phelps
Program Director
Academic Year Institutes Programs
National Science Foundation (NSF)
Washington, D.C.

Surveys reveal that there are approximately 100,000 people teaching mathematics in grades 7 through 12, but not all of these are full-time mathematics teachers. Of this 100,000, about 50,000 are members of the National Council of Teachers of Mathematics, so less than one-half are interested in becoming members of that professional organization. An even smaller number of them attend institutes each year.

By the best estimates, the number of teachers of mathematics of grades 7–12 who attend each year the various institutes supported by the National Science Foundation totals less than 18,000. Over the past 9 years, institutes have been conducted for about 60 or 70 thousand teachers of mathematics. Because some have participated in more than one, the number of individual teachers who have been to one or more institutes is more likely to be about 30,000. So, again, this is less than the membership of the Council and fewer than one-third of the number of teachers in the field. And yet this effort for the supplementary preparation of secondary schoolteachers of mathematics is costing about $17 million each year.

What are the purposes of the National Science Foundation efforts in this field? The Foundation has approached this from the point of view of being sure that the eventual end-product of research in mathematics and science is strengthened by having appropriately prepared teachers at the early stages. For this purpose the Foundation has emphasized the strengthening and updating of the fundamental knowledge of mathematics of the various teachers of the country. We are trying to provide the teachers with adequate mathematical background knowledge so that they are better prepared to make professional judgments on what should be done in the classroom. Part of the effort results also in training for leadership in the field of teaching. Those people who become most knowledgeable about the subject will probably tend to be among the leaders of the future.

There is a peripheral influence of our institutes. That is the influence upon the colleges and universities which conduct the institutes, which may help them see better the problems of teaching in the schools, so that they can modernize their teacher education curricula, and so that the teachers of the future may have better undergraduate preparation than our current teachers.

In the rather vast Federal Government structure, the position of the National Science Foundation is not always well understood. The Foundation was established by an Act of Congress as an organization whose sole function is to provide resources to the scientific community in order to develop the science potential of the country. To interpret this rather broad governmental language, this means that what we are doing is merely providing grants to the scientific community—which consists primarily of colleges and universities, but to some extent also of the professional organizations in the field—so that they can conduct programs. The NSF does not conduct programs directly. The nature of the Federal structure and philosophy is such that the Foundation in doing this is trying not to tell school districts or State school systems what they should do, and not to work directly with the State school systems and local school systems for the most part. This latter function is carried on by the U.S. Office of Education.

How else can we be useful? I think one of the things which has been mentioned here already is the use of trained teachers who may have received their training in academic year institutes or summer institutes. The use of these key teachers for inservice education of their colleagues is one of the best ways to reach the other two-thirds of the group which we have not been able to reach directly. This is particularly true in the elementary school field, in which the Foundation has done relatively little. We have supported a few institutes—summer institutes and inservice institutes—for elementary school personnel. Principally these have been aimed at what one might call the key teachers in the field—the elementary supervisor of mathematics, the specialist teacher in the classrooms rather than the general teacher, and the teacher who is prepared to go back and conduct inservice work for her colleagues.

Even at this level our efforts are quite clearly very small. There are close to 1,000,000 elementary school teachers in the Nation, grades 1 through 6, and we have about 1,000 of these teachers in inservice institutes conducted by the Foundation and another 1,000 in summer institutes in mathematics and science combined. This means that the total of 1,000 elementary school people who are getting some preparation in mathematics is less than 0.1 percent of the teachers of the country. The question has been raised at times as to whether we shouldn't have a large number of summer institutes or inservice institutes for elementary school teachers, but multiplying the present efforts by a factor of 50 or 100 would cost a considerable amount of money. The chief problem here is that while there are 100,000 high school teachers and 1,000,000 elementary school teachers, there are probably less than 10,000 teachers of mathematics at the college level. The bottleneck is perhaps in the total number of college staff available for staffing training programs. The tentative conclusion which we have been able to draw from this is that the appropriate way to deal with the elementary school teaching problem is to educate the *future* teachers better, and to use the existing well-prepared high school teachers or well-prepared elementary school teachers to work in inservice programs with their colleagues.

Little has been said about efforts of the Foundation to improve the course content because most of you are familiar with these. Again, they are approached from the point of view of trying to make available proper samples of modern ways of doing things, and beyond this the commercial publishers can and probably will take over.

"The Role of the U.S. Office of Education Instructional Resources Branch"

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As Congress was considering the National Defense Education Act in 1958, the need for the improvement of instruction in science, mathematics, and modern foreign languages in the public elementary and secondary schools of this Nation was evident. The part of the Act which provides this improvement program is Title III. It has two essential parts. The acquisitions part provides matching funds to State educational agencies for the procurement of laboratory and other special equipment, including audiovisual materials, and for minor remodeling of existing space for the use of the equipment acquired in the three subject fields. The other part of Title III provides States with matching funds to assist them in the expansion and improvement of their program of supervisory and related services to public elementary and secondary schools in the fields of science, mathematics, and modern foreign language, and in the administration of the State plan. The law specifies that these funds be expended solely for the purposes designated.

The regulations of the Act define supervisory services to mean the services rendered by qualified persons in the promotion, maintenance, and improvement of instruction. Related services are interpreted to mean services particularly applicable to the supervision of persons providing instruction in public elementary and/or secondary schools in the three fields. The regulations also give as examples of such activities the following: demonstration of effective utilization of equipment, the development of materials helpful in the improvement of such instruction, and the distribution to local educational agencies of materials so developed.

A liberal interpretation of these regulations has been followed, giving rise to many different types of programs which are serving to improve instruction in the three fields. Mathematics workshops of many different types and kinds have been financed through the use of these funds. Conferences of short duration dealing with new developments in both content and methods of teaching mathematics have been arranged. Publications and curriculum bulletins have been produced and distributed as a result of this program. The office of the State supervisor of mathematics has served a valuable liaison function between mathematics in the public schools and in institutions of higher learning. Working conferences dealing with updating and upgrading mathematics teacher certification have been provided. In short, this program has facilitated the exertion of a constant force of significant magnitude at the State level directed toward the improvement of mathematics education. This program in no way conflicts with the activities supported by the National Science Foundation in the area of inservice education or the preservice preparation of mathematics and science teachers. Therefore, it has been established that inservice activities supported by Title III funds cannot offer academic credit.

If we look at the total Federal expenditures in this program through January 31, 1963, we find an amount of slightly more than $9 million. Since the inception of the program there would have been available to the States an additional $7.5 million if they could have supplied the appropriate matching funds. In most cases there is a legitimate reason for States not being able to match or use these monies. The reason for making this information available is to challenge you, as State supervisors of mathematics, to investigate your own situation with the objective in mind of assessing your State's program, and in so doing, you may find that more money can be made available to support an expanded mathematics inservice program. If your State is not taking advantage of its full allotment, and if additional State-level funds to be used for matching are totally unavailable, then perhaps there exist other possibilities of acquiring matching funds. In some cases grants have been secured from industry to provide matching funds for the State-level supervisory and related services program. Two other Office of Education sources of financial support should be mentioned: the Cooperative Research and the Title VII programs. Both of these are research-oriented and necessitate the preparation of a formal proposal. Both programs are established to serve education in general rather than mathematics specifically. In the past, these programs have supplied very valuable support to a limited number of well-designed mathematical activities. Therefore, if you have new and creative ideas for projects related to the specified objectives of either or both of these programs, I would urge you to prepare and submit a proposal.

In closing, may I say that those of us concerned with mathematics here in the Office of Education believe that the services which you perform and the programs which you have established are making a significant contribution to the improvement of mathematics education throughout the Nation. If we may be of any service in assisting you in expanding or extending your present efforts, please let us hear from you.

"The Role of the U.S. Office of Education Educational Media Branch"

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The purpose of Title VII of the National Defense Education Act is to determine the role of the new communication media in elementary, secondary, and higher education. Thus far, as much as $5 million has been obligated annually for grants and contracts with public and nonprofit organizations under this Title of the Act.

Title VII has two parts. Part A, The Research Program, provides that funds may be used to "conduct, assist, and foster research and experimentation in the development and evaluation of projects involving television, radio, motion pictures, and related media of communication which may prove of value to State or local educational agencies in the operation of their public elementary or secondary schools, and to institutions of higher education, including the development of new and more effective techniques and methods—(1) for utilizing and adapting motion pictures, video tapes, and other audiovisual aids, filmstrips, slides, and other visual aids, recordings (including magnetic tapes) and other auditory aids, and radio or television program scripts for such purposes; (2) for preparing teachers to utilize such media with maximum effectiveness; and (3) for presenting academic subject matter through such media." Support is provided through grants or contracts. Proposals submitted before two annual cutoff dates, February 1 and August 1, are evaluated by the Advisory Committee on New Educational Media. Ordinarily, there is a minimum period of two and one-half months between submission and approval or rejection of applications.

The criteria used to evaluate the research proposals are as follows:

Pertinence

(1) Is the proposed project relevant to the purposes of Title VII?

Educational significance

(2) To what extent will this project contribute to the development of new and more effective techniques and methods for

utilizing and adapting new media, training teachers to use new media, or for presenting subject matter through new media?

(3) How significant is the educational problem on which this proposal is focused?

(4) How generalizable are the anticipated outcomes of the proposed research?

Research and experimental design

(5) Is the problem clearly defined?

(6) Does the proposed research grow out of an adequate knowledge of related research?

(7) To what extent does the proposed project duplicate previous research and/or research currently being supported under Title VII?

(8) Are the questions to be answered or hypotheses to be tested well formulated and clearly stated?

(9) How adequate is the research procedure or experimental design (including controls, sampling, data gathering instruments, etc., where appropriate)?

(10) How appropriate are the plans for analysis of the data to be collected?

Personnel and facilities

(11) To what extent has the director or principal investigator demonstrated his competence for directing research in the area involved?

(12) Does the institution or agency submitting the proposal have, or will it obtain, adequate facilities for carrying out the project?

Economic efficiency

(13) How economical is the suggested approach to the problem in terms of overall cost as compared with the cost of alternative approaches?

Part A also includes a small grant program for research and experimentation in the new educational media. The purpose of the small grant program is to encourage pilot research studies that give promise of findings leading possibly to research undertakings of greater magnitude. The total grant may not exceed $3,500 plus indirect costs, and the project must not extend beyond 1 year. These grants may not be used in lieu of fellowships, scholarships, or traineeships.

While the Title VII research program does not support the general production of new materials, such production may be supported to the extent necessary to test hypotheses applicable beyond a specific set of materials. Research has established the practicability of the new media. The need now is to maximize the effects of their use. This is the direction research should take.

The second part of the Act is Part B, The Dissemination Program. This program supports studies and surveys related to the utilization of new media, prepares publications relative to their use, and provides exhibits, conferences, and demonstrations to advance the use of the new media. Support for such activities is provided through contracts with qualified persons, institutions, or agencies. Proposals for dissemination contracts may be submitted at any time.

Deliberations of the Conference Seminars

Introduction

One of the working papers prepared for use in the Conference and distributed at the opening session was a list of questions that had been received from the field, such as who starts inservice programs, how are they financed, and other related inquiries. This paper served as the discussion guide used in the final session. Participants were assigned to one of three groups, and each group was charged with the responsibility of seeking answers to the questions posed in the prepared list. Reports from each of the seminar groups were prepared by recorders and filed with the Conference proceedings.

Many of these questions or related ones have been of real concern to those responsible for initiating, expanding, or improving inservice education programs in their States, counties, cities, or school districts. Since one of the purposes of this publication is to make available to others the knowledge and experiences gained by those who have been actively engaged in providing such programs for mathematics teachers, it appeared that the Conference report would be more useful if the information gained from the various papers and discussions were summarized as responses to a number of these specific questions. The nine questions selected as the basis for organizing the information in this part of the report and summaries of the discussion follow.

1. Who Starts Inservice Programs?

Mathematics staffs of institutions of higher education.—A few years ago, when experimentation with new curricular materials began on a wide scale, colleges and universities took the responsibility of providing inservice education for teachers. In many projects, such as those of the University of Maryland and of the University of Illinois Committee on School Mathematics, the university staffs, in classes and workshops, prepared teachers to use the experimental materials. State and local school systems have continued to draw heavily on colleges for help in planning procedures, organizing activities, getting the inservice programs under way, and teaching the classes.

State departments of education.—State supervisors of mathematics have taken the leadership in many States in getting programs started. In 1-day meetings of administrators, supervisors, and mathematics teachers, they have drawn attention to the great expansion of mathematical knowledge, its applications in technology, and the implications for the classroom. These meetings have usually been followed by longer institutes and workshops. Maine, for instance, has held a number of 1- or 2-day workshops on the new movements in mathematics and has emphasized the implications for elementary school teachers.

In the first phase of its "Project Idaho," Idaho covered the State with five 1-day regional meetings of school administrators. Mathematicians from universities and colleges, the State supervisor of mathematics, and a specialist in mathematics from the U.S. Office of Education were consultants at the conferences. These conferences emphasized the need for inservice education for mathematics teachers, explained the project and enlisted support of administrators, and solicited nominations of well-prepared teachers to participate in a 2-week leadership workshop. This workshop helped prepare 24 teachers to serve as consultants to local programs.

Ohio has held a number of 1-day county workshops to review trends in modern mathematics for all mathematics teachers of the county schools in order to inform them about materials and to encourage them to undertake individual study. These workshops have frequently produced a demand for more extensive inservice education.

Committees for curriculum study and production.—A committee studying mathematics curriculums of a particular school system with a view to updating them can provide a sound beginning for an extended inservice program by pointing out areas that need strengthening. Its suggestions may lead to inservice workshops, institutes, or formal courses of instruction. The Illinois inservice workshops for elementary school mathematics teachers were first suggested in a report called *The Teaching of Mathematics in Illinois*, published in April 1958, after 3 years of intensive study by the Mathematics Study Group of the Planning Committee for the Allerton House Conference on Education in Illinois.

A study by Michigan's Department of Public Instruction of the innovations in the curriculum in Michigan schools in the past 5 years is expected to have many implications for their Committee on Mathematics and for inservice education.

Georgia found an unusual and decidedly beneficial outcome of the procedures used in the preparation and distribution of its mathematics guide. The latter was first published in a limited edition and issued only to 27 school systems that had been used as pilot schools in 1961–62. The restricted distribution proved to have a desirable psychological effect on the other mathematics teachers, who heard about the guide for almost a year before it was made available to them. Thus, in the fall of 1962, they were quite eager to get the copies and their acceptance was good. The teachers' lack of knowledge about topics treated in the guide led to requests for widespread inservice work in mathematics.

Texas credits its Mathematics Curriculum Commission, composed of school administrators, representatives from industry, teachers, and university and college mathematicians, with providing sound and stimulating guidance in the development of the State's new curriculum guide in mathematics. The Commission's work is also reflected in the State bulletin, *Principles and Standards for Accrediting Elementary and Secondary Schools and Descriptions of Approved Courses, Grades 7–12.*

Most States are working on some school level of mathematics curriculum. In North Carolina, for example, after several months of preliminary work, a 21-member committee is coordinating the preparation of a curriculum guide for junior and senior high schools.

Textbook committees.—Local administrators and supervisors have found a textbook committee useful in initiating inservice education. Discussion of the criteria for selection of text materials, the new information provided by consultants, and review of the new texts all help to acquaint teachers with the new mathematics and to develop leadership in the inservice work that follows the introduction of a new textbook series.

Professional organizations and their affiliated groups.—The National Council of Teachers of Mathematics (NCTM) has helped keep the States informed of developments in mathematics through its journals—*The Mathematics Teacher* and *The Arithmetic Teacher*—its yearbooks, and smaller publications prepared to meet specific needs. One outstanding service was its work with school administrators in eight regional conferences held in various sections of the country. The conference report, summarized in the *Revolution in School Mathematics—a Challenge for Administrators and Teachers*, points up the need for inservice education.

Affiliates of NCTM have started inservice programs. The Ohio Council of Teachers of Mathematics, for example, furnishes consultants for local inservice institutes in the State.

The District of Columbia Council of Teachers of Mathematics and many other such NCTM affiliates have held a 1-day institute with emphasis on the elementary school program. These have led to a greater interest in NCTM and its publications, and to further inservice work.

Cooperating organizations.—Several organizations working together have stimulated professional growth, acquainted teachers with developments in their fields, and stimulated wider participation in inservice programs. The weekend conference at Gearhart, Oregon, in October 1962, was a joint effort of the State departments of education of Oregon and Washington and all NCTM affiliates in the two States. The Associated Teachers of Mathematics in Connecticut (ATOMIC) is cooperating with the State department of education in sponsoring a 1-week summer institute for elementary school teachers. Principals and supervisors participate in some of the sessions. The Illinois Council of Teachers of Mathematics cooperated with the mathematics consultants of the office of the State superintendent of public instruction in staffing their first series of workshops.

The officers of the Georgia Mathematics Council have worked cooperatively with the State mathematics consultants in improving mathematics education and have devoted some Council programs to the State's new curriculum guide. Louisiana's 3-day Mid-Winter Conference of parish, city, and State supervisors, was devoted entirely to the new mathematics.

2. How Can Qualified Instructors Be Provided in Quantity?

The demand for instructors for inservice classes has become so great that college staffs are now faced with more requests for inservice mathematical classes than their time will permit. Schools have therefore had to look to other sources for instructors.

Outstanding elementary school teachers.—Both New York State and Washington, D.C., have successfully used outstanding elementary school teachers to teach inservice courses.

Teachers who have attended NSF institutes.—The reservoir of teachers of mathematics, about 30,000 who have attended one or more NSF institutes, is now a potential source of supply for instructors. However, conferees generally agreed that, in addition to a knowledge of mathematics, instructors of inservice classes for elementary school teachers should have pleasing personalities, teaching experience on or near the same level as that of members of the class, the ability to communicate, and they should be people who are recognized as leaders by their colleagues. They also agreed that instructors of mathematics teachers in elementary schools would be more effective if they attended one or more preparatory sessions before they taught and other sessions after they had taught several classes to discuss their experiences and problems. Plans should then be developed for these instructors to orient another group of inservice instructors.

In its NSF programs, Washington State University at Pullman has conducted seminars in "The Foundations of Arithmetic" for elementary school teachers. These seminars were made available to a selected group of NSF participants who could qualify on the basis of mathematical competence, a desire to conduct a course for their colleagues, and a statement from their local superintendents or school boards that they and their colleagues would be given time, opportunity, and financial support for such inservice work during the academic year.

Arizona's Phoenix Union High Schools System and Arizona State University cooperatively initiated a pilot project similar to that in Washington. Since the University had conducted NSF institutes the director knew the qualifications of the participants and could assist in selecting the NSF Fellow to serve as the instructor of the inservice class for secondary school mathematics teachers and could later advise him on the program. The SMSG *First Course in Algebra* was used as the study text. The project is being continued.

Bowling Green State University, Bowling Green, Ohio, with financial support from the National Science Foundation, has developed an academic year institute with a related summer program for 30 secondary school teachers of mathematics. Preference is given to applicants with 3 or more years of teaching experience, and stipends are provided to attract qualified candidates.

The institute has two independent sequences—an Instructional Personnel Sequence designed for 25 secondary school teachers and a Supervisory Sequence for 5 prospective supervisors. Both sequences provide for an intensive study program in mathematics. Participants in the Instructional Personnel Sequence are involved in an intern-study program in which each is assigned to a pre-calculus modern mathematics class for observation purposes, in which each is required to attend all meetings of his class, and in which each has opportunities to work with the regular class instructor in planning and executing lessons. The purpose of the intern-study program is to develop in teachers perception of the relevance of mathematical concepts to the mathematics of the secondary school. The intern service proposes to give the participants a thorough acquaintance with modern curricular materials. A Seminar in the Teaching of Secondary School Mathematics is a supplement to the intern program.

Participants in the Supervisory Sequence spend about half-time in a cooperating local school system. The supervisory intern experience includes instruction of a one-semester secondary school class and the instruction of a one-semester inservice class in mathematics for teachers of the school system. In return for the services of the intern supervisor, the local school system makes a financial contribution to the university.

It is anticipated that institute study will prepare participants in the Instructional Personnel Sequence also to conduct mathematics inservice education programs in their own school systems.

Other qualified persons.—The Georgia State department of education and the University of Georgia have a cooperative venture planned for a 6-week workshop to prepare well-qualified mathematics teachers to teach graduate credit courses at various centers over the State and under the direction of a University mathematics staff member.

"Project Idaho" is a bootstrap organization to carry on inservice education. With some financial support from the National Council of Teachers of Mathematics and extra consultant service from the mathematics specialists of the U.S. Office of Education, the project is designed to develop a core of qualified instructors of inservice classes. They will also provide leadership in developing local inservice classes and in spreading the program throughout the State.

3. What Uses of Newer Media Are Being Made in Inservice Education?

Television.—There are many projects in educational television under way throughout the country. Some are designed primarily for direct student instruction in contemporary mathematics, with teacher inservice education an incidental outcome. Some have inservice education of teachers as a primary objective.

Delaware-Seaford and one or two other districts have used the Delmarva television program covering various aspects of mathematics instruction in the elementary school. Fees are paid on a per-pupil basis from school district funds. Students are dismissed early, so that teachers can begin viewing at 3:00 p.m. Telecasts are often followed by a faculty discussion period.

North Carolina has a weekly series "Methods for Modern Teachers," which is televised in many parts of the State. Three or four of the programs during the year deal with mathematics. The University of North Carolina is rerunning the Continental Classroom series.

Oklahoma's Midwest City Schools fourth-grade teachers conducted SMSG Mathematics by television. In their weekly meetings they were assisted by an Oklahoma University instructor.

Oregon has completed a series of television inservice mathematics telecasts and is evaluating them.

Utah has tentative plans for a television inservice program in mathematics. Planning and preparation for the series is being done by the State Secondary Mathematics Curriculum Committee.

Vermont's WCAX-TV presented a 4-week series dealing with the language of mathematics for teacher orientation. Daily telecasts dealt with the properties of numbers and operations, concepts and symbolism of sets, equations and inequalities, and the graphing of equations and inequalities. The weekly half-hour telecasts for classroom instruction in elementary mathematics also served as a means of inservice education for the teacher viewers.

The Greater Washington, D.C. Educational Television Station, WETA, presented a program on "Contemporary Mathematics" for elementary school teachers in the school year 1962–63. Each 1-hour program was telecast on Mondays and Wednesdays at 3:30 p.m. and on Thursdays at 7:30 p.m. Some nearby districts required teachers to view the program, others encouraged them to do so. The University of Virginia Extension Division enabled teachers to use it as a means for earning college credit for the course.

Washington State's Clover Park television station has presented a series of 16 half-hour tapes in weekly showings for elementary school teachers.

Increased and expanded use of television is anticipated. In Georgia and Illinois, proposals have been made to reach all parts of the States by linkage of 11 or 12 television stations.

Kinescopes and tapes.—New York State has used kinescopes and tapes extensively for several years. The State education department made kinescope recordings of a full year's televised course of 89 half-hour lectures in "Modern Mathematics" and telecast them from various centers. These 16 mm. sound films have since been shown at various centers about the State, where mathematics teachers view and discuss them. A complete set of lecture notes is furnished free to teachers. These films have proved an excellent means of inservice education for senior high school teachers with relatively strong mathematics background. Several sets of these films have been furnished at cost to other State departments of education.

New York also has furnished a television inservice course of 30 lessons for junior high school mathematics teachers and one of 36 lessons for elementary school teachers. Tapes of both are available free from the State to television stations. It is planned to convert these tapes to 16 mm. films to make them more readily accessible to teachers.

Films.—Pennsylvania has used films extensively for inservice education, including "Teacher Education in Modern Mathematics," a series of 5 films on new content recommended by the Commission on Mathematics; "Understanding Numbers," a series of 7 half-hour films for elementary school teachers, that is also useful to junior high school teachers; "Elementary Mathematics Film Series" and "Junior High School Mathematics Film Series," 2 series of half-hour films on the Greater Cleveland Mathematics Program.

"Films for Mathematics Teachers"—about 210 half-hour films financed by NSF and produced by the Minnesota National Laboratory—presents a series of demonstration lessons using the SMSG materials for each of grades 7 through 12. There is also a set of 14 to 20 lectures for teachers at each grade level on the mathematical background of the new courses.

"Films in Mathematics for Elementary School Teachers," a project also financed by NSF, is designed to produce 12 half-hour kinescopes for an inservice program. The films will very likely be made available through a cost-rental-purchase plan. Further information may be obtained from the Director of Field Services, State College of Iowa, Cedar Falls, Iowa.

Transparencies for overhead projectors.—With the greatly increased use of overhead projectors, transparencies for them have become very useful, especially with large classes.

The Texas Education Agency, by arrangement with SMSG, has developed an almost complete series of transparencies for the 7th-, 8th-, and 9th-grade SMSG courses being taught in their inservice program. Aside from being instructional aids, these visuals make it possible for the instructor to compress much more material into the class time.

Programed materials.—Programed materials are also serving a useful purpose. The State Department of Public Instruction of North Carolina in cooperation with Duke University has planned institutes for elementary school supervisors in which programed materials will be used. Pennsylvania has made programed materials available to teachers.

4. How Can Mathematics Inservice Programs Be Financed?

Regular appropriations by State legislature.—The usual source of funds is a regular appropriation by the State legislature. The amount ppropriated largely determines the number of consultants that can e provided, the amount of matching NDEA funds, and the elements f inservice education.

Special appropriations by State legislature.—North Carolina ppropriated $300,000 for the 1961–63 biennium for an inservice ducation program under the State department of public instruction.

Georgia, through its grant-in-aid program, gives many teachers n opportunity to attend summer school. To be eligible for a grant, teacher must hold a bachelor's degree, have 2 years of satisfactory teaching experience, and make a specified qualifying score on the National Teachers Examination; also, during the year after he attends summer school, he must be employed full-time in teaching mathematics. The grants pay $300 for 6 weeks' study, or $450 for 9 weeks'. The teacher may attend college in any State provided he is pursuing an approved graduate program which leads to a Georgia 5- or 6-year teaching certificate. During the past 3 years, 109 secondary school teachers have done graduate work in mathematics under this program.

Virginia appropriated $200,000 for the year 1963–64 for inservice education in all areas of the school curriculum. The 1960 Appropriations Act designated that a part of the funds be used for summer institutes. Institutes in mathematics have been set up at State-supported colleges and are conducted similarly to those of the National Science Foundation.

Federal funds.—Federal support for inservice education is made available from two main sources. Title III of the National Defense Education Act makes matching funds available to the State departments of education to be expended in accordance with the approved plans. The expansion and improvement of many inservice programs has been made possible by the use of funds from this source.

The other major source of funds is the National Science Foundation, which makes grants directly to colleges and universities to conduct summer, academic year, and inservice institutes in mathematics. The Foundation also supports the Cooperative College and School Program for joint improvement of school curriculum and teacher education, a program that has recently been initiated.

Budgets of local school systems.—It appears that as local school authorities become aware of the need for continuing education of mathematics teachers, the local school systems become willing to underwrite the costs in whole or in part. A number of the conferees reported that substantial amounts were being included in some local budgets to implement such programs. It is possible that in most local districts this may become the major source of funds.

Joint support from several agencies.—Funding and accounting procedures in some States permit joint use of Federal, State, and local funds for inservice education. For example, in South Carolina, where local funds may be used for matching purposes in securing Federal funds under NDEA, Title III, inservice workshops are sponsored jointly by the State department of education and local districts. The Department finances and directs the workshops, and the local district remits 50 percent of the total cost to the State for use in matching Federal funds.

Business and industry.—In some States local business or industry has made substantial contributions to improve the competence of teachers in their communities. For instance, business interests in Richmond, Va., sponsored a 2-week workshop for mathematics teachers.

Corporations have also sponsored summer institutes for mathematics teachers for a number of years; large corporations, such as Shell Oil Company, General Electric Company, have been doing this annually, and others, from time to time.

The conferees recommended that supervisors investigate the availability of other possible local sources of support.

Teachers.—Although inservice education has received an added impetus in recent years by greatly increased financial help, most teachers still use their own funds for professional improvement.

5. What Is the Role of Professional Organizations and Federal Agencies in Inservice Education?

National Council of Teachers of Mathematics (NCTM).—Most of the services of NCTM are for the general professional improvement of teachers. These services include the monthly magazines (*The Mathematics Teacher* and *The Arithmetic Teacher*), the *Mathematics Student Journal*, yearbooks, supplementary publications for specific needs, and regional and national meetings, special conferences and projects.

The report of NCTM's conferences, mentioned earlier, is summarized in the publication "The Revolution in School Mathematics," which was sent free to all members of NCTM.

A committee on Inservice Education has been appointed by NCTM. Members of this particular committee were among the participants at the U.S. Office of Education Conference on Inservice Education. The committee held a meeting at the conclusion of the conference to consider ways of implementing the recommendations made during the conference discussions.

Other NCTM committees or groups are working on professional standards, relations with industry, and also on such special projects as mathematics for the slow learner and films for elementary school teachers. NCTM also cooperates with other organizations in many professional activities.

Mathematical Association of America (MAA).—The efforts of MAA's Teacher Training Panel, a subcommittee of its Committee on the Undergraduate Program in Mathematics (CUPM) to improve the preservice preparation of mathematics teachers, will affect inservice education. Its guidelines, course outlines, and point of view are expected to be useful in both the preservice and inservice programs. MAA also contributes to inservice education in other ways. MAA lecturers who go to high schools to speak at meetings of high school students are available for meetings with teachers in a particular school or area.

The Mathematical Monthly, the regular publication of MAA, contains much that is of interest to secondary school teachers, including a special section "Mathematical Education Notes."

The Conference Board of the Mathematical Sciences (CBMS).—This Board was organized because of the common interests of various mathematical associations. These special interest groups recognized that the education of mathematics specialists, including those in research, depends upon the quality of instruction offered at each grade level of the mathematics program, and that the preparation of mathematics teachers is a matter of increasing concern to all of them.

In the CBMS Forum for Mathematical Education, administrators faced with decision-making on mathematical instruction have a central place through which to relay requests for cooperation to various parts of the mathematical community. Thus, the CBMS can serve as a means of communication on problems and solutions.

National Science Foundation (NSF).—NSF makes financial grants to the scientific community, primarily to colleges and universities, in support of programs designed to improve mathematics education. Among these are (a) summer, academic year, and inservice institutes; (b) experimental curriculum projects including those of SMSG; and (c) research programs.

The institute program is the largest; it reached an estimated 30,000 secondary school mathematics teachers over the past 9 years at a cost of about $90 million. NSF institutes emphasize the strengthening and updating of the teachers' fundamental knowledge of mathematics. The institutes have included an estimated one-third of the secondary school teachers of mathematics, but relatively few of the elementary school teachers.

NSF also makes grants for the production of materials. The School Mathematics Study Group (SMSG), the broadest of these programs, brings together expert mathematicians and educators to prepare text materials for elementary and secondary school mathematics. SMSG has already published sample textbooks for grades 4 through 12 (they are being made available for classroom use by commercial publishers) and is preparing experimental materials for the earlier grades. All SMSG texts are accompanied by commentaries for teachers which give answers to problems and some background on specific topics. SMSG also publishes "Studies in Mathematics" to help teachers with various phases of mathematics.

NSF has also made grants for the production of films for use in inservice programs and for a television course "Patterns in Arithmetic," designed to test the idea of teaching arithmetic to teachers and pupils simultaneously. The lessons cover the standard arithmetic program from a modern point of view. Separate telecasts give the teacher a preview of the content to be presented during successive 3-week periods.

National Aeronautics and Space Administration (NASA).—NASA sponsored a week's conference on "Mathematics and the Space Age" for State mathematics supervisors and spacemobile lecturers at the Marshall Space Flight Center in order to give both groups an occasion to study and discuss the application of mathematics to problems of the space age. It also gave them an opportunity to exchange information and coordinate their educational programs.

Publications of NASA are supplying mathematics teachers with suggestions for up-to-date and exciting applications of the mathematics that they are teaching.

U.S. Office of Education (USOE).—The Office contributes to inservice education through the Federal grant program it administers and through the work of its specialists in mathematics. Under Title III of the National Defense Education Act (improvement of instruction in mathematics, science, and foreign languages, and expansion and improvement of supervisory and related services), the Office makes funds available to the States.

These funds have been used for mathematics workshops of many types, conferences dealing with developments in content and methods, publication and distribution of curriculum bulletins, and other purposes.

The annual Federal allotment for this program makes available to any State no matter how small or sparsely populated as much as $20,000. The annual Federal expenditure may amount to $400,000 for one of the heavily populated States. Through January 1963, more than $9 million in Federal funds have been expended for this purpose. An additional $7.5 million was available had the State been able to supply matching funds.

Title VII (research grants and dissemination programs) makes funds available for research in the uses of new educational media and for the dissemination of research findings.

The purpose of this part of the Act is to determine the role of the newer educational media in education. Grants may be made to any public or nonpublic agency. Formal proposals for grants must be submitted for consideration at February 1 or August 1 deadlines. The criteria used in evaluating the proposals are:

(a) Is the purpose of the proposal relevant to that of the Act?
(b) Is the problem of educational significance?
(c) Is the research strategy clearly and carefully designed?
(d) Are personnel and facilities adequate?
(e) Is the proposed approach economically efficient?

Funds in the amount of $5,000,000 annually have been available through Title VII.

The primary responsibility of USOE specialists in mathematics is to assist in the national effort to improve the quality of instruction in school mathematics.

To accomplish this mission, the specialists (a) cooperate with State departments of education in their efforts to improve instruction, (b) study progams for the educationally disadvantaged for the double purpose of assisting the schools and securing information useful to the Office of Education, (c) keep up with developments in curriculum improvement, inservice programs, and other innovations in elementary and secondary education to disseminate the information they gather, (d) maintain close contact with college and university staffs to encourage them to improve their inservice programs for mathematics teachers and their research in mathematics education, (e) cooperate with persons in other Federal and professional organizations in planning programs to improve the quality of mathematics instruction, and (f) prepare publications that will be useful to mathematics teachers and supervisors.

6. How Should Parents Be Informed of the Changing Mathematics Curriculum?

As a matter of good public relations, parents should be informed of major decisions affecting the education of their children. Receiving prior information of plans to update the mathematics curriculum will not eliminate all of the problems arising from these plans, but it may decrease their number. Many parents are quite eager for their children to participate in the "new" mathematics program and are pleased to receive the announcement of a curriculum revision to include it. Disappointment comes to some parents when their children fail to receive assignment to classes receiving instruction in contemporary mathematics.

Then, too, change often brings insecurity and resistance. This can reach frustrating levels when the parent finds himself unable to do his child's homework assignment in the "new" mathematics. As a "Parent's Lament," a verse in the *NEA Journal*, stated:

> Two heads are better than one, they say.
> I thought so until today.
> Gropingly I tried to lick
> My twelve year old's arithmetic.

Anticipation of these problems and the inclusion of relevant information in the school's publicity materials can do much to ease the pressures that frequently accompany curriculum changes.

All teachers in a school can assist in building public understanding of the need for the contemporary mathematics if they have been kept informed of the advances in mathematics education and of the school's plans to include them in its curriculum study. Consequently, all teachers should have a part in planning programs aimed at informing the public. Several means may be used to reach the public.

Television.—Open circuit television broadcasts that beam instruction into the mathematics classrooms or inservice programs to teachers are frequently tuned in by the parents. Viewers can thereby gain increased understanding of the changing mathematics curriculums.

Newspaper stories.—Local newspapers have provided special news stories describing the nature of the changes in the mathematics curriculum and reasons for their introduction into the school program. Occasionally the reporting may give a distorted view of terminology usage, but most reports are well-written and contribute much toward public acceptance of the changes.

Films.—Some of the films developed primarily for teacher viewing are also suitable for showing to parents. A joint project of the MAA, NCTM, and SMSG proposes to produce a series of films in color to assist elementary school teachers to gain additional background for teaching the structure and unifying concepts of mathematics. These films may be useful with parent and lay groups in building an understanding of the need for updating the content of the mathematics curriculum and of the nature of the recent emphases.

Evening classes for parents.—Some schools have found it useful to provide special evening classes for parents whose children are studying contemporary mathematics. Schools in the San Francisco Bay area as well as several school systems in Maryland and Virginia have offered such courses, and large numbers of parents have enrolled.

Meetings of organizations.—Program meetings of Parent-Teacher Associations, of service and civic groups, using teacher presentations to tell of the recent trends in mathematics have helped to develop understanding of the new curriculums.

Special bulletins.—Some schools have found it effective to prepare a 1- or 2-page report on the reasons for changes in the mathematics curriculum and to send copies of these to the parents.

The NCTM has issued an attractive 8-page leaflet "*The New Mathematics Curriculum—What and Why*," which provides answers to some questions often asked by parents, teachers, and administrators.

7. What Are Some Special Features of Present Inservice Programs?

Using experimental materials for individual or class study.—The materials being produced in connection with the many curriculum experiments have been valuable in inservice work. Both informal and formal courses have used such experimental materials as those from the University of Maryland, the University of Illinois Committee on School Mathematics, the School Mathematics Study Group, Boston College, and Ball State Teachers College.

Offering noncredit courses.—In a noncredit course the instructor can adapt instruction to the needs of the participants. In addition, supervisors say, noncredit courses attract many teachers who hesitate to enroll in the college credit courses for fear that testing, grade marks, and other evaluative measures may jeopardize their security.

Illinois has made much use of the noncredit course for teachers of elementary school mathematics. A series of eight lessons on *Number and Operation* has been used as the basic text in its workshops with much success. North Dakota has also used these materials in its program of workshops.

Offering credit courses designed to strengthen background.—That many teachers need to gain a stronger background in mathematics is recognized and college credit courses are being developed to meet this need. These bear mathematics course numbers on the college transcripts of the teacher participants and thus offer added encouragement for professional growth. NSF institutes have been of outstanding service in developing such courses.

New Mexico has had favorable results in developing this phase of the inservice offerings.

Selecting course content for elementary school teachers.—The Pennsylvania Department of Public Instruction has worked out an unusual plan for developing a course for teachers. It has divided the State into 13 areas, and in each has named a person to serve as chairman. These chairmen constitute an advisory body to the Department on the inservice program. Each chairman also serves as a key person in his area; he explains the program and assists in organizing inservice classes for regional groups of teachers with similar teaching responsibilities. The Department guidelines describe the responsibilities of both the instructor and the class members. Each class elects two representatives, who meet periodically with the instructor and the regional chairman to discuss the program so that it will meet the teachers' needs.

Some Alabama counties use the SMSG volumes on *Number Systems* and *Concepts of Algebra* in background courses for teachers of elementary school mathematics; others use SMSG *Mathematics for Junior High School* to prepare for teaching at that level. Through such books teachers become familiar with newer concepts and the framework of the mathematics structure.

In order to meet a persistent demand for a superior course in mathematics content with suggestions for application in the classroom, the advisory committee of the Northeastern Regional Instructional Television Library Project of the Eastern Educational Network has developed a content course in mathematics which starts with the topics of elementary school arithmetic and enriches them for teachers. This course has proved to be very successful.

Emphasizing particular areas of need.—For 1 year, West Virginia has emphasized inservice education in mathematics for the elementary school teacher. The State department of education, working in coordination with colleges in the State, sponsored college-centered inservice workshops and supplied instruction to workshops for elementary school teachers located in 10 other counties. The Department arranged for the participants in several centers to extend the inservice work to other teachers in their counties.

In its mathematics inservice program for 1962–63, Rhode Island focused attention upon the needs of teachers in grades 4, 5, and 6. A major segment of the junior-senior high school mathematics teachers were reached by workshops in 1961–62.

New textbooks.—The California State Curriculum Commission has planned to adopt new textbooks for grades K–8, with the books to be placed in use in September 1965. The Advisory Committee on Mathematics, in its report to the State Curriculum Commission, has defined the *Strands of Mathematical Concepts* that give unity to the mathematics curriculum. Anticipating that the textbooks adopted will incorporate these concepts and that they will differ so greatly from those formerly used that inservice education will be essential, the committee is preparing materials for teachers to use in the transition period in the junior high school grades. The materials for students will include units on whole numbers, geometry, measurement, rational numbers, decimals-ratio-percentage, and inequalities- absolute value-graphing, and will cover about 4 weeks each. A related handbook on each unit will provide the teacher with the background mathematics necessary to the teaching of that particular unit. Materials for students will be available to the local school districts in manuscript form which the districts may reproduce in quantity for class use. The State department of education will provide the teachers' handbook for all junior high school teachers upon request from the local district. Before 1965, when the new textbooks are to be used, there will be time to add new content to existing programs and to conduct inservice courses for mathematics teachers.

When the Salt Lake City, Utah, district adopted new textbooks, the city school system held inservice classes for teachers of junior high school mathematics to acquaint them with the district's newly adopted texts.

Materials for independent study by teachers.—In an attempt to reach the vast numbers of mathematics teachers, some groups are preparing materials for individual teacher study. The School Mathematics Study Group, for instance, developed such study guides as one of its earliest projects.

The Texas Education Agency prepared self-instructing materials for all of its elementary school teachers of mathematics covering several levels of study.

Offering opportunities for informal discussion.—To stimulate communication between the class members and their inservice instructor, some schools are providing breaks in the time schedule for informal discussion. Rhode Island has scheduled a "coffee break" midway in its 2½-hour sessions to serve two purposes: (a) to give teachers an opportunity to relax and become acquainted with teachers from other communities, and (b) to give time for participants to ask questions of their instructor. Their questions give the instructor a basis for adapting his instruction to meet their problems.

West Virginia broke 4-hour sessions with a 1-hour intermission so that participants might eat their evening meal together. The informal discussions during the meal hour were, some participants said, a very vital part of the instructional program.

Holding seminars for supervisors and administrators.—Puerto Rico held ten 1-day seminars for elementary school principals and assistant superintendents in charge of rural schools who, in turn, directed the inservice programs in their schools.

To improve supervision, the District of Columbia conducted a series of four 2-hour conferences for elementary school principals, at which they discussed the mathematical concepts to be developed, provision for student practice, drill, and mastery, and related topics, and observed a demonstration lesson taught by a regular classroom teacher. Afterwards a mathematics consultant took the lead in evaluating the demonstration lesson. Principals were enthusiastic in requesting a continuation of this program.

One source of the strength of Maryland's program is the participation of local school superintendents, and administrative and supervisory personnel in the orientation and inservice programs. An annual State 2-day conference acquaints local elementary school supervisors and principals with new ideas and new directions in mathematics education. A similar annual conference is held for secondary school personnel. Regional conferences of several school systems are held to meet specific needs; for example, two 3-day sessions were held to inform elementary school supervisors and principals of recent trends in arithmetic—emphases, procedures, research, and materials of instruction.

Providing courses in computer mathematics.—Some school systems are already offering courses related to electronic computers. New York State is sponsoring free instruction of mathematics in computer mathematics at Columbia University, the University of Buffalo, the University of Rochester, and Syracuse University. The objectives of the course are threefold:

a. To provide an opportunity to understand the role of computers in mathematics and mathematics education.

b. To provide instruction in some areas of numerical analysis applicable to computers.

c. To provide some skill as a programer in both machine language and some symbolic language.

Cooperating with State departments and colleges and universities.—Under a cooperative arrangement with the Tennessee State department of education, the State-supported colleges and universities of Tennessee provide space for seven regional offices. In each office there is one State department staff member who serves as a regional supervisor in curriculum and supervision. The regional office may also have staff members in special education, guidance, or other areas.

The supervisor assists local school officials in his region in planning and executing programs in all areas of instruction. His location on a university campus enables him to maintain communication between university and local school officials and to assist administrators in acquiring the services of specialists. The supervisor develops a keen awareness of the strengths and needs existing in the schools of his region and contributes help where it is most needed.

This kind of organization has strengthened the working relationships among the colleges and universities, the State department, and the local school systems. It holds much promise as an effective method for providing inservice education for teachers, including teachers of mathematics.

Conducting correspondence courses.—The University of Wisconsin Extension Division and the National Science Foundation are making "Basic Concepts of Algebra" available as a correspondence course in modern algebra for secondary school teachers. The course is based on the SMSG Studies in Mathematics, Vol. VIII, *Concepts of Algebra* and Vol. III, *Structure of Elementary Algebra.*

Providing time for inservice work.—The problem of finding time for inservice mathematics education may be solved by setting time aside for it in the annual school calendar. In Tennessee, teachers are paid for 10 days of inservice education as part of the school year, and local school district authorities decide how the time is to be spent. Many systems have chosen to concentrate attention upon mathematics.

A similar provision of time for inservice education during the contractual period is made by some local school districts. Dade County, Fla., requires its new teachers to participate in 2 weeks of orientation prior to the opening of school. The period covered by the contracts of experienced teachers includes 5 days for planning and meeting just previous to the opening of the school year. Experienced teachers who are new to Dade County must participate in a 2-week subject matter workshop before they can advance to the fourth step on the salary schedule.

Montgomery County, Md., holds a 2-week workshop prior to the opening of school for secondary school mathematics teachers new to the county school system. Pay is in addition to the contractual amount for the regular school year.

Using newsletters, bibliographies.—Many forms of publications are being used to keep teachers, supervisors, and administrators informed on current developments in mathematics education. Recent news issues from Maine, New Mexico, North Carolina, and West Virginia carried 42 pages of material under 52 title headings. These titles indicate the variety in content:

Inservice Education Experiments are Begun
An Experiment With Programed Text Books
A Teaching Adventure with Twelfth Grade Remedial Work
Elementary Mathematics Preservice Recommendations
Shell Merit Fellowships at Cornell University
Help for 100
A Study of Mathematical Abilities
Curriculum Committee is Organized
New Geometry Text is Called for by State Board
Why Isn't It Negative—Tips for Teachers
What of 1963, Mathematically Speaking?
Intermediate Algebra in Grade Nine?
Modern Mathematics Correspondence Course
Modern Mathematics—The Saga of Two Old Teachers
What is "Modern" Mathematics?

8. How Can Pilot Projects Be Started?

Some States have developed an extensive and coordinated program of inservice mathematics education activities. In other States, there appear to be scattered efforts by local school systems but little activity at the State level. What are the factors in these situations?

Criteria for pilot projects.—If a pilot project on ways of providing inservice education for mathematics teachers is needed, what criteria might be used to determine the type of project worth financial or leadership support? These have been suggested:

(a) Does the proposal involve a different or unusual approach to one or more aspects of inservice education?
(b) Can the project serve as a model for use by other school systems?
(c) Is the strategy of the project clearly and carefully designed?
(d) Does the proposal hold promise for success?

Initiative in planning.—Any person or group with interest, enthusiasm, and ambition to undertake a pilot project could take the initiative in planning one.

State or local project.—The needs of the particular situation would most likely determine whether the project should be conducted at the State or local level. Counsel on the decision might be sought from staffs of colleges or universities, State departments of education, professional mathematical associations, State educational associations, affiliated groups, or from specialists in the U.S. Office of Education.

Potential sources of financial assistance.—From whom might financial assistance be available? If the State receives Federal funds under provisions of the National Defense Education Act, the State department of education might be asked whether the proposal is eligible for matching funds. If the proposal calls for a college and a school system to work together to improve school curriculum and teacher education, the college may be able to secure financial support for it from the National Science Foundation. Such a project might qualify for participation in their *Cooperative College and School Program.*

Several examples of pilot projects which hold promise in inservice education have been mentioned in this bulletin. One is Project Idaho, which was described in the State report of Idaho. Two other such pilot projects—the Bowling Green State University Institute and the Washington State University Institute—were described in the Seminar Report on "How Can Qualified Instructors Be Provided in Quantity?"

9. Some Unanswered Questions and Problems

(1) What are the criteria to be used in selecting highly successful instructors of inservice mathematics classes? What procedures will result in effective applications of the criteria?

(2) There are various sources of financial support for programs of inservice mathematics education. A single publication listing these sources, the eligibility requirements for participation, and the application procedures to be used should be made available to State supervisors and others.

(3) Firm lines of communication need to be established among all groups making decisions on the inservice education of mathematics teachers. How can this best be done?

(4) How can the efforts of private and public institutions be more effectively coordinated?

(5) Many local school systems need information identifying people who are qualified and willing to assist in inservice mathematics programs. Compilation of such a listing by

a professional organization could contribute to mathematics education.

(6) In what ways can the slower achievers learn mathematics more effectively? the faster achievers?

(7) Apparently a sizable number of teachers lack sufficient motivation to improve their competence in teaching mathematics by participating in programs. What measures, if any, should be taken in this situation?

(8) Should a larger proportion of NDEA, Title III, funds be given to mathematics? Is the present division of 73.8 percent to science, 17.6 percent to languages and 8.6 percent to mathematics equitable?

(9) How can the contributions of professional organizations to inservice education be expanded?

(10) What should be the guidelines for the content of inservice courses in elementary school mathematics?

(11) How can the vast number of elementary school teachers acquire the depth of knowledge they need?

(12) How can the effectiveness of inservice education programs for mathematics be measured? Do pupils of teachers who have participated in inservice programs show evidence of improvement in knowledge, interest, and attitude related to mathematics? What objective measures of evaluation can be conveniently applied?

Checklists

One of the working papers prepared by the Conference planners was a set of checklists which individuals might find helpful as a ready source of ideas for use with their own inservice programs. Conferees were requested to make such revisions in the various items as would make the lists of greater value to potential users, and to submit their revised lists during the final session. This procedure did not permit a consensus for each of the statements, but the opinion was almost unanimous that the checklists should be included in the report of the Conference.

It is emphasized that these checklists have been prepared in order to *suggest* ideas for inservice programs, not to *judge* individual programs. Some questions apply more appropriately at State level than at local level; some questions may not apply at all in a particular situation.

It was suggested that the checklists might be useful to various groups of people: administrators who are making plans to set up inservice programs; mathematics advisory committees working on local or state curiculum and inservice plans; supervisors in the various levels of a particular school system; state supervisors who are planning and organizing inservice education; college staffs which are planning inservice programs.

Users of the checklists might find it helpful to duplicate them and use them for discussion purposes.

CHECKLIST No. 1: Getting An Inservice Program Started

1. Have the professional personnel become aware of what is new in mathematics and the implications for inservice education?
2. Is leadership available from a supervisor, principal, or superintendent?
3. Has assistance been sought from the State department of education?

4. Are the administrators stimulating the planning and organizing of the inservice programs?
5. Have the persons in leadership positions taken the initiative in taking the first steps in planning inservice programs?
6. Has the responsibility for organizing and developing the inservice program been definitely assigned?
7. Has a study been made of the needs of teachers in connection with the new mathematics?
8. Has identification been made of the potential sources of assistance in planning, developing, or executing the programs?
9. Have provisions been made for teachers to have a part in setting up the program, through surveys, suggestions, expressions of preferences?
10. Have a few teachers in the school or school system used and evaluated one or more of the modern experimental programs with their classes?
11. Have the present courses of study been evaluated in terms of the new needs in mathematics?
12. Has the cooperation of colleges and universities been sought in fulfilling needs for inservice work?
13. Have plans been made for informing parents and the public of the curriculum changes that are needed or under way?
14. Have guidelines been formalized in writing to give direction and continuity to the inservice programs?

CHECKLIST No. 2: Expanding Inservice Programs

1. Are there communication and cooperation among school administrators, professional organizations, and colleges which are sponsoring inservice programs?
2. Are teachers encouraged to become members of their professional organizations and grow professionally by attending their meetings, reading their journals and publications, and thus becoming aware of trends and activities in their field?
3. Are inservice or extension classes located so that they will be available to a maximum number of teachers with a minimum amount of travel?
4. Is provision made for inservice opportunities for general elementary school supervisors and principals separately from classroom teachers?

5. Are teams of secondary and elementary school personnel working together as leaders in inservice work?
6. Is quality instruction provided for each inservice class?
7. Is the instructional program of inservice classes appropriate to the level of preparation of the teachers who are enrolled?
8. Is the content of the inservice courses organized so as to insure adequate attention to the unifying concepts of mathematics?
9. Is use being made of many new media for instruction, such as television, kinescopes of television programs, programed textbooks, overhead projectors?
10. Is use made of capable NSF Fellows who have desirable personality traits and who are recognized as leaders by their colleagues, in making more inservice programs available?
11. Are the inservice programs fulfilling the needs of teachers of children of all abilities—the slow learner, the retarded, the underachiever, the average, the gifted?
12. Are there noncredit offerings as well as courses for credit?
13. Has a variety of approaches been used, such as study groups, seminars, workshops, institutes, committee work?
14. Are teachers encouraged to study and to try out experimental programs?
15. Are administrators appointing teacher committees to study and select new textbooks and other materials for use in teaching?
16. Are bibliographies prepared and distributed to promote individual professional study?
17. Are bulletins or newsletters issued to keep teachers and professional leaders informed of current developments? Are some sections or issues written for the elementary school teacher?
18. Is information disseminated on inservice opportunities provided by summer, academic year, and inservice institutes sponsored by the National Science Foundation?
19. Is information about new programs and practices in mathematics being sought out and made available?
20. Are opportunities provided for teachers to discuss mathematics curriculum improvements with other groups such as PTA, civic groups, other school systems?
21. Is released time made available for inservice work for elementary school teachers? for secondary school teachers?
22. Have mathematics laboratories been set up which can be used as instructional centers for inservice education?
23. Are the resources of the community utilized—personnel, financial support, etc.?

CHECKLIST No. 3: Financing Inservice Programs

A. Have provisions been made for financial support by:
  1. State departments of education?
  2. The local school district?
  3. An intermediate school unit?
  4. NDEA?
  5. NSF?
  6. Other Federal funds?
  7. Joint support from several agencies?
  8. Business and industry?
  9. Other community sources?

B. Are there financial provisions for:
  1. Leadership (consultants, instructors, study group leaders, etc.) for inservice programs?
  2. Professional books and materials for study by teachers?
  3. Experimentation with programed or other materials for some kinds of inservice work?
  4. School participation in educational television projects?
  5. Expenses for teachers, principals, and supervisors to attend institutes?
  6. Released time for special assignments or inservice work such as classes which meet at some distance from the school, curriculum work?
  7. Salary increments in recognition of professional growth in approved inservice work?
  8. Salaries for teachers who do curriculum work for their district or State in the summer?
  9. Grants-in-aid, depending on the fulfilling of certain requirements, for teachers to take college courses in the summer?

CHECKLIST No. 4: Evaluating Inservice Programs

1. Is information collected to indicate the numbers of teachers participating in inservice programs? elementary? secondary?
2. Are periodic evaluations made to determine the strengths and weaknesses of the inservice program?
3. Does classroom teaching reflect updated content? updated method?
4. Has the inservice work resulted in updated courses of study in mathematics? elementary? junior high? senior high?

5. Has interest been stimulated in discovering more about how students learn mathematics?
6. Do pupils of teachers who participate in inservice programs give evidence of increased achievement, added interest, or improved attitudes in mathematics?
7. Do the students demonstrate increased proficiency in mathematics at the next school level?
8. Has the inservice program contributed to an evaluation of the mathematics curriculum and instruction in the school?
9. Have college mathematics offerings and content been modified to recognize the advances made at the precollege level?
10. Do teachers' activities and membership in professional mathematics organizations reflect renewed interest gained from inservice education?
11. Is there an increase in the percentage of students taking elective courses in mathematics? girls? boys?
12. Is there evidence that the pupils are doing a better job in science since the new programs were begun?
13. Do the parents report that the pupils indicate that mathematics is important?
14. Have provisions been made to secure teachers' evaluation of the inservice program?
15. Is there increased and more effective use of materials of instruction by teachers who have participated in inservice programs?

APPENDIX

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This annotated bibliography has been prepared by the staff participants in the Conference to assist the reader who seeks information on inservice education beyond that included in this report.

Brown, Kenneth E. "Improved Programs in Mathematics Require Inservice Education for Teachers." *The Mathematics Teacher*, 54: 85–89, February 1961.

Discusses the need for changes in the mathematics curriculum, major experimental projects in mathematics, and how administrators are helping in the inservice education of mathematics teachers.

Brown, Kenneth E. *and* Daniel W. Snader. "*Inservice Education of High School Mathematics Teachers.*" (Bulletin No. 10, OE–29022) U.S. Department of Health, Education, and Welfare, Office of Education. 1961. 109 p.

Includes three papers presented at a conference devoted to the inservice education of high school mathematics teachers. Also reports on the discussions of group sessions dealing with promising practices in small, medium-size, and large school systems. The appendix includes a listing of books found to be helpful by State departments of education and by local school systems.

"Center for Programed Instruction, The." *The American Mathematical Monthly*, 69: 229–31, March 1962.

Describes the purpose for the development of the Center and its source of financing. States that perhaps the most significant aspect of the work of the Center is the fact that a research project, initiated at the school level, is committed to a radical examination of both the learning and teaching processes. Describes the materials in mathematics which are being programed.

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Presents two listings: (1) programed materials in mathematics known to be available or expected to become available by September 1, 1962, and (2) machines that are essential for presenting available mathematics programs or are known to be compatible with those programs. Also has a selected bibliography of 24 listings.

Ficken, F. A. "The Use of Films and Television in Mathematics Education." *The American Mathematical Monthly*, 65: 393–403, June–July 1958.

Relates background for the appointment by the National Academy of Sciences of a Film (and Television) Evaluation Board (FEB) to develop criteria on con-

tent and objectives for production and use of filmed or televised mathematical lectures. Reports the FEB-recommended action and policy with supporting arguments.

FORBES, JACK E. "Programmed Instructional Materials—Past, Present, and Future." *The Mathematics Teacher*, 56: 224–27, April 1963.

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HOUSTON, W. ROBERT *and* M. VERE DE VAULT. "Mathematics Inservice Education; Teacher Growth Increases Pupil Growth." *The Arithmetic Teacher*, 10: 243–47, May 1963.

Reports the results of a study in Dallas, Tex., involving 89 intermediate grade mathematics teachers and 1,977 of their pupils. Concludes that the inservice education program was effective in increasing mathematics achievement for both pupils and teachers. Evidence indicates that teachers who are in the process of changing are most likely to effect similar change or growth in their pupils. Further research is needed on this project.

Instructional Television Library Project. *Instructional Television Materials: A Guide to Films, Kinescopes, and Videotapes Available for Televised Use.* Winter, 1962–63. 55 p. National Instructional Television Library, New York, New York.

Describes 282 telecourses available directly from distributors for broadcast and closed circuit use. It also lists courses still being planned or produced, as well as selected publications on instructional television. A total of 24 telecourses in mathematics are listed, 8 of which are designed for inservice education with 4 of the latter for elementary school teachers.

JOHNS, O. D. "A Cooperative Inservice Teacher Education Program in the New Mathematics for Elementary Schools." *The Arithmetic Teacher*, 9: 221–223, April 1962.

Relates some of the preliminary activities of the University of Oklahoma that emphasized the need to find more efficient ways of using University staff

resources. A cooperative agreement was reached between participating school districts and the University whereby an inservice education program for teachers of arithmetic would be provided by the University. A weekly televised program, consultant service to teachers, and a series of Saturday conferences were parts of the organized inservice education plan.

Jones, Phillip S. "Notes on the Status and Future of Films and TV in Collegiate Mathematics Education." *The American Mathematical Monthly,* 65: 403–16, June–July 1958.

Includes part of a report by the Committee on Instructional Films to the Board of Governors of the Mathematical Association of America summarizing what seemed to be the present status and immediate future of (1) research in the use of these media, (2) current and recently completed projects using films and television in teaching mathematics (68 listings), and (3) the needs and possible audiences which it considered. Includes a bibliography listing 42 references to mathematics on television.

Kavett, Hyman. "Newsletter: a Means of Mathematics Communication." *The Arithmetic Teacher,* 9: 224–26, April 1962.

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Mueller, Francis J. "Five Recommendations to School Systems for Improving Secondary Mathematics Instruction." *The Mathematics Teacher,* 55: 637–42, December 1962.

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Schult, Veryl and others. *Supervisor of Mathematics, His Role in the Improvement of Mathematics Instruction, The.* National Council of Teachers of Mathematics, Washington, D.C. 1959. 10 p.

The bulletin was prepared by a committee of the National Council of Teachers of Mathematics. Includes sections on Federal money for improving supervisory services in mathematics, selection of mathematics supervisors, their responsibilities, cooperative efforts of classroom teacher and supervisor. Use of color in printing makes for attractive format.

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Snader, Daniel W. *Secondary School Mathematics in Transition.* (Bulletin OE–29014) U.S. Department of Health, Education, and Welfare, Office of Education. 1960. 11 p.

Besides a discussion of the "new" in mathematics, the article contains a checklist of 100 suggestions for improving the content and teaching of mathematics.

Snader, Daniel W. *The Leadership Role of State Supervisors of Mathematics.* (Bulletin No. 1, OE–29032) U.S. Department of Health, Education, and Welfare, Office of Education. 1962. 107 p.

Reports on a conference designed to help State supervisors of mathematics develop constructive leadership programs. The text of eight papers presented at the conference is included. Appendix A lists recommended leadership activities for State supervisors of mathematics.

Sparks, Jack N. "Arithmetic Understandings Needed by Elementary-School Teachers." *The Arithmetic Teacher*, 8: 395–403, December 1961.

Reports on four aspects of the problem under (a) what mathematical understandings should elementary teachers have; (b) what mathematical understandings do teachers have; (c) what training in mathematics are teachers getting; and (d) how can mathematical understandings of elementary teachers be improved.

Proposes further research on (a) what is the relationship between pupil achievement and teacher knowledge; and (b) what content materials and types of presentation provide teachers with the knowledge found most valuable as a result of the above studies.

Spitzer, Herbert F. "Today's Mathematics—and You." *Grade Teacher*, 79: 49+, April 1962.

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Swineford, Edwin J. "Ninety Suggestions on the Teaching of Mathematics in the Junior High School." *The Mathematics Teacher*, 54: 145–48, March 1961.

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Describes a particular approach being explored extensively in the Dade County Schools, Fla. One teacher and class at each grade level, 1–6, are designated as a "pilot teacher" and a "pilot class" in a "pilot school" in each of the seven school zones. Demonstration lessons, after-school planning sessions for all teachers in a pilot school, with grade level groups being led by the pilot teacher at that grade level, with all efforts pointed toward incorporating modern mathematics into the elementary school program. The effects of this program are spreading. Other features of the Dade County inservice program are described.

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Wright, Betty Atwell. "Anatomy of Change in Elementary Mathematics." *The Arithmetic Teacher*, 10: 158–61, March 1963.

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